

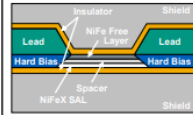
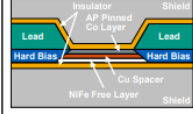
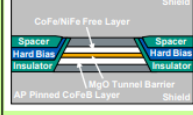
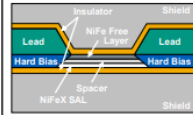
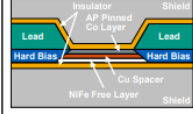
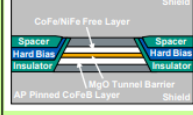
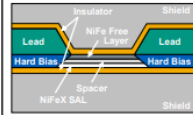
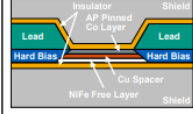
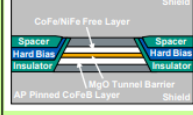
EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

On information and belief, Western Digital Corporation and Western Digital Technologies, Inc. (collectively, “Western Digital” or “WD”) Accused Products, including their hard disk drives (“HDDs”) infringe U.S. Patent No. 11,737,372.

'372 Claim 1	Exemplary Western Digital Infringement
1. A magnetoresistive device comprising a magnetic tunnel junction structure comprising:	If the preamble is limiting, on information and belief, each of WD’s hard disk drives includes a tunneling magnetoresistive (Tunneling MR) reading head, which is a magnetoresistive (MR) device having a tunnel barrier junction structure as claimed. <i>See, e.g.,</i> Terris presentation (Western Digital presentation):¹

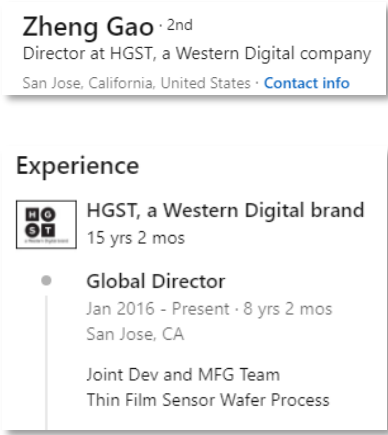
¹ Bruce D Terris, “Magnetic Recording and Magnetic Memory,” presentation at IEEE Magnetism Society Summer School, Virginia Commonwealth University, June 5, 2019, (Copy accessible at <https://egr.vcu.edu/media/engineering/documents/mne/TerrisSummerSchool2019fordistribution.pdf>)

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'372 Claim 1	Exemplary Western Digital Infringement																																				
	Read Head Sensor Technologies <table><tr><th>Year</th><th>1st Density (Gb/in²)</th><th>Sensor Technology</th><th>Structure</th><th>MR Effect</th><th>Sense Current Geometry</th></tr><tr><td>1979</td><td>0.01 Gb/in²</td><td>Thin-film Inductive</td><td></td><td>N/A</td><td>N/A</td></tr><tr><td>1991</td><td>0.1 Gb/in²</td><td>MR Sensor</td><td></td><td>Anisotropic MR</td><td>CIP</td></tr><tr><td>1997</td><td>2 Gb/in²</td><td>Spin Valve</td><td></td><td>Giant MR</td><td>CIP</td></tr><tr><td>2006</td><td>100 Gb/in²</td><td>Tunnel Valve</td><td></td><td>Tunneling MR</td><td>CPP</td></tr><tr><td>?</td><td>>1Tb/in²</td><td>?</td><td>?</td><td>?</td><td>?</td></tr></table> Western Digital. ©2016 Western Digital Corporation or affiliates. All rights reserved.	Year	1 st Density (Gb/in ²)	Sensor Technology	Structure	MR Effect	Sense Current Geometry	1979	0.01 Gb/in ²	Thin-film Inductive		N/A	N/A	1991	0.1 Gb/in ²	MR Sensor		Anisotropic MR	CIP	1997	2 Gb/in ²	Spin Valve		Giant MR	CIP	2006	100 Gb/in ²	Tunnel Valve		Tunneling MR	CPP	?	>1Tb/in ²	?	?	?	?
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?	>1Tb/in ²	?	?	?	?																																
	WD designs and manufactures “substantially all of the recording heads [] required for our products,” according to WD’s most recent 10-K.² A WD patent filed in 2020 and issued in 2022 (U.S. Patent No. 11,283,006, the “’006 Patent”) also describes a “magnetoresistive device [that] includes a read head,” “[t]he read head is a tunneling magnetoresistive reader.” ’006 Patent, Abstract. The ’006 Patent lists Zheng Gao as an inventor,																																				

² 2023 10-K, available at <https://investor.wdc.com/static-files/9468af6f-967f-4709-bcaf-c0e9510264dd>, at 8.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	who according to LinkedIn is presently Global Director for a “joint Dev and MFG team thin film sensor wafer process” at HGST, a WD company. 
a tunnel barrier layer;	On information and belief, the WD Accused Products include a tunnel barrier layer. For example, WD uses MgO as a tunnel barrier in the TMR read heads of its hard disk drives, located between said first ferromagnetic material layer and said second ferromagnetic material layer. For instance, the Terris presentation contains a slide titled “Read Head Sensor Technologies” which appears to show that since 2006, a Tunneling MR sensor has a structure that includes a MgO tunnel barrier between a CoFeB layer and a CoFe/NiFe layer.³

³ See *supra* footnote 1, at 22.

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Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

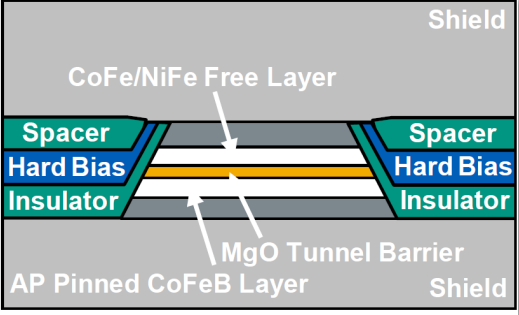
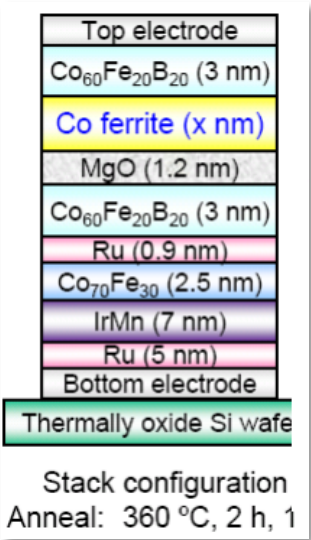
'372 Claim 1	Exemplary Western Digital Infringement
	 WD's '006 Patent illustrates a barrier layer 420 in FIG. 4B that is described as including "MgO with (001) crystalline texture." '006 Patent, 10:7-13.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	The ferromagnetic nanolayers 413, 431 interface with the barrier layer 420 and promote the crystalline texture of the barrier layer 420, such as a barrier layer that includes MgO with (001) crystalline texture. In one embodiment, which <i>See also '006 Patent, claim 8.</i> 8. The magnetic sensor of claim 1, wherein the barrier layer comprises MgO.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

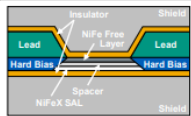
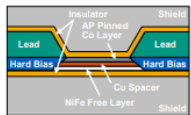
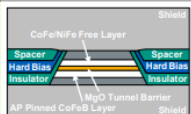
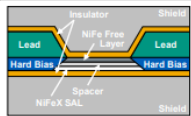
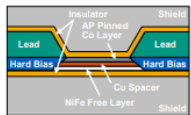
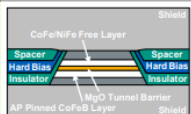
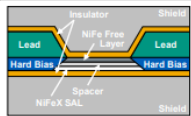
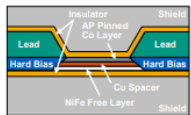
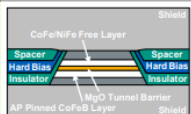
'372 Claim 1	Exemplary Western Digital Infringement
	Further, a 2013 presentation by a member of HGST's Read Head Development team describes a "Thin Film Read Magnetic Sensor" with the following structure comprising a MgO layer between ferromagnetic layers including two CoFeB layers.⁴ The CoFeB layers are ferromagnetic material layers and include a first ferromagnetic material layer. HGST was acquired as a subsidiary of WD in 2012, and since 2018 WD has transitioned away from hard disk drive products using the HGST brand into the WD branding.⁵ The same presentation cites Dr. Yuasa's 2004 publication in a slide titled "TMR Barrier from Year 2004."⁶  Stack configuration Anneal: 360 °C, 2 h, 1
a first ferromagnetic material layer of the BCC	On information and belief, the WD Accused Products include a first ferromagnetic material layer of the BCC [Body-Centered Cubic] structure formed on a first side of said tunnel barrier layer.

⁴ https://nccavs-usergroups.avs.org/wp-content/uploads/PAG2013/2013_4gao.pdf at 12.

⁵ <https://www.guru3d.com/story/western-digital-moves-away-from-the-hgst-branding>.

⁶ See *supra*, footnote 4 at 10.

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'372 Claim 1	Exemplary Western Digital Infringement																																				
structure formed on a first side of said tunnel barrier layer; and	For example, the Terris presentation contains a slide titled “Read Head Sensor Technologies” which shows that since 2006, a Tunneling MR sensor has a structure that includes a MgO tunnel barrier between a CoFeB layer and a CoFe/NiFe layer.⁷ The CoFe/NiFe layer is a first ferromagnetic material layer formed on a first side of said tunnel barrier layer. Read Head Sensor Technologies <table><tr><th>Year</th><th>1st Density (Gb/in²)</th><th>Sensor Technology</th><th>Structure</th><th>MR Effect</th><th>Sense Current Geometry</th></tr><tr><td>1979</td><td>0.01 Gb/in²</td><td>Thin-film Inductive</td><td></td><td>N/A</td><td>N/A</td></tr><tr><td>1991</td><td>0.1 Gb/in²</td><td>MR Sensor</td><td></td><td>Anisotropic MR</td><td>CIP</td></tr><tr><td>1997</td><td>2 Gb/in²</td><td>Spin Valve</td><td></td><td>Giant MR</td><td>CIP</td></tr><tr><td>2006</td><td>100 Gb/in²</td><td>Tunnel Valve</td><td></td><td>Tunneling MR</td><td>CPP</td></tr><tr><td>?</td><td>>1Tb/in²</td><td>?</td><td>?</td><td>?</td><td>?</td></tr></table> Western Digital. ©2016 Western Digital Corporation or affiliates. All rights reserved.	Year	1 st Density (Gb/in ²)	Sensor Technology	Structure	MR Effect	Sense Current Geometry	1979	0.01 Gb/in ²	Thin-film Inductive		N/A	N/A	1991	0.1 Gb/in ²	MR Sensor		Anisotropic MR	CIP	1997	2 Gb/in ²	Spin Valve		Giant MR	CIP	2006	100 Gb/in ²	Tunnel Valve		Tunneling MR	CPP	?	>1Tb/in ²	?	?	?	?
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⁷ See *supra*, footnote 1 at 22.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	WD's '006 Patent describes a magnetoresistive device 401 that includes a CoFe ferromagnetic nanolayer 413 in the "first free layer 410." '006 Patent, FIG. 4B. CoFe nanolayer 413 has "a body centered cubic (BCC) configuration." <i>Id.</i>, 10:30-33. Layer 413 is a first ferromagnetic material layer formed on a first side of said tunnel barrier layer.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	401 SHIELD (S2) CAPPING LAYER 440 LAYER 435 INSERTION LAYER 434 BORON LAYER 432 Co INSERTION LAYER 445 CoFe INSERTION LAYER 444 CoFe NANOLAYER 431 BARRIER LAYER 420 CoFe NANOLAYER 413 Co INSERTION LAYER 443 CoFe INSERTION LAYER 442 BORON LAYER 412 INSERTION LAYER 414 LAYER 405 BUFFER LAYER 404 SEED LAYER 402 SHIELD (S1) FIG. 4B SECOND FREE LAYER 430 FIRST FREE LAYER 410 First side First ferromagnetic layer <i>See also '006 Patent, claim 14.</i>

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	14. A magnetic sensor, comprising: a seed layer; a barrier layer above the seed layer; a free layer above the barrier layer, the free layer comprising: a ferromagnetic nanolayer on the barrier layer, the ferromagnetic nanolayer comprising a crystalline structure that is BCC; an amorphous layer above the ferromagnetic nanolayer, one or more layers between the ferromagnetic nanolayer and the amorphous layer, the one or more layers comprising a crystalline structure that is FCC, wherein the one or more layers between the ferromagnetic nanolayer and the amorphous layer comprise: a first layer comprising CoFe; and a second layer comprising Co; and a non-ferromagnetic capping layer above the free layer. Further, the 2013 presentation by HGST describes a “Thin Film Read Magnetic Sensor” with the following structure comprising a MgO layer between ferromagnetic layers including two CoFeB layers.⁸ The CoFeB layers are ferromagnetic material layers and include a first ferromagnetic material layer.

⁸ See *supra*, footnote 4.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

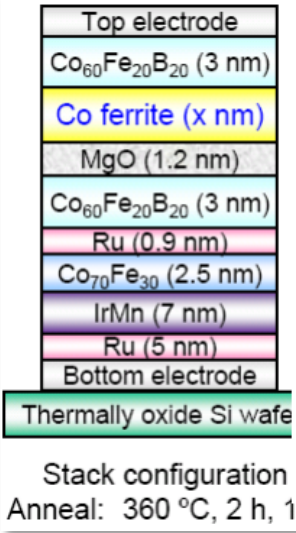
'372 Claim 1	Exemplary Western Digital Infringement
	 Stack configuration Anneal: 360 °C, 2 h, 1
a second ferromagnetic material layer of the BCC structure formed on a second side of said tunnel barrier layer,	On information and belief, the WD Accused Products include a second ferromagnetic material layer of the BCC structure formed on a second side of said tunnel barrier layer. For example, WD's '006 Patent describes a magnetoresistive device 401 that includes a CoFe ferromagnetic nanolayer 431 in the "second free layer 430." '006 Patent, FIG. 4B. CoFe nanolayer 431 has "a body centered cubic (BCC) configuration." <i>Id.</i>, 10:30-33. Layer 431 is a second ferromagnetic material layer formed on a second side of said tunnel barrier layer.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	401 SHIELD (S2) CAPPING LAYER 440 LAYER 435 INSERTION LAYER 434 BORON LAYER 432 Co INSERTION LAYER 445 CoFe INSERTION LAYER 444 CoFe NANOLAYER 431 BARRIER LAYER 420 CoFe NANOLAYER 413 Co INSERTION LAYER 443 CoFe INSERTION LAYER 442 BORON LAYER 412 INSERTION LAYER 414 LAYER 405 BUFFER LAYER 404 SEED LAYER 402 SHIELD (S1) SECOND FREE LAYER 430 FIRST FREE LAYER 410 FIG. 4B Second side Second ferromagnetic layer <i>See also '006 Patent, claim 15.</i>

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	14. A magnetic sensor, comprising: a seed layer; a barrier layer above the seed layer; a free layer above the barrier layer, the free layer comprising: a ferromagnetic nanolayer on the barrier layer, the ferromagnetic nanolayer comprising a crystalline structure that is BCC; an amorphous layer above the ferromagnetic nanolayer, one or more layers between the ferromagnetic nanolayer and the amorphous layer, the one or more layers comprising a crystalline structure that is FCC, wherein the one or more layers between the ferromagnetic nanolayer and the amorphous layer comprise: a first layer comprising CoFe; and a second layer comprising Co; and a non-ferromagnetic capping layer above the free layer. 15. The magnetic sensor of claim 14, wherein the crystalline structure of the one or more layers between the ferromagnetic nanolayer and the amorphous layer is grown as FCC or HCP on the ferromagnetic nanolayer from a material having a crystalline structure that is BCC. In addition, the sensor structure illustrated in the Terris presentation which includes a MgO tunnel barrier between a CoFeB layer and a CoFe/NiFe layer.⁹ The CoFeB layer is a second ferromagnetic material layer.

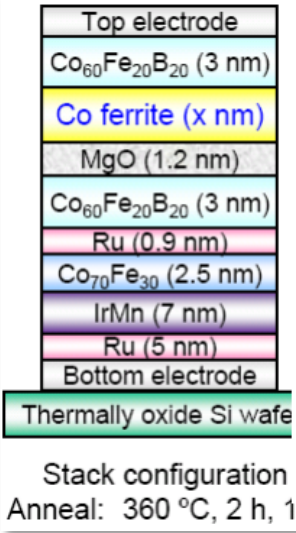
⁹ See *supra*, footnote 1 at 22.

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'372 Claim 1	Exemplary Western Digital Infringement
	The diagram shows a cross-section of a magnetic sensor. At the top is a grey 'Shield' layer. Below it is a 'CoFe/NiFe Free Layer' (grey). This is followed by a stack of three layers: a green 'Spacer', a blue 'Hard Bias' layer, and a green 'Insulator' layer. Below these is an 'MgO Tunnel Barrier' (orange). At the bottom is an 'AP Pinned CoFeB Layer' (grey), which is also labeled as a 'Shield' on the right side. Arrows point from the labels to their respective layers. Further, the 2013 presentation by a member of HGST’s Read Head Development team describes a “Thin Film Read Magnetic Sensor” with the following structure comprising a MgO layer between ferromagnetic layers including two CoFeB layers.¹⁰ The CoFeB layers are ferromagnetic material layers and include a second ferromagnetic material layer.

¹⁰ See *supra*, footnote 4.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	 Stack configuration Anneal: 360 °C, 2 h, 1
wherein said tunnel barrier layer is formed by a single-crystalline MgOx (001) layer or a poly-crystalline MgOx (0<x<1) layer in which the (001) crystal plane is preferentially oriented.	On information and belief, the WD Accused Products include the tunnel barrier layer being formed by a single-crystalline MgOx (001) layer or a poly-crystalline MgOx (0<x<1) layer in which the (001) crystal plane is preferentially oriented. For example, WD uses MgO as a tunnel barrier in the TMR read heads of its hard disk drives, located between said first ferromagnetic material layer and said second ferromagnetic material layer. For instance, in a 2022 report published by Seagate and Western Digital describes “[C]ontinued optimization of MgO MTJ stack,” “improved low RA FeCo/MgO stack” and “improved tunnel barrier quality” in the context of “future reader designs, challenges, and []potential solution paths.”¹¹

¹¹ G. Albuquerque, S. Hernandez, M. T. Kief, D. Mauri and L. Wang, “HDD Reader Technology Roadmap to an Areal Density of 4 Tbps and Beyond,” in *IEEE Transactions on Magnetism*, vol. 58, no. 2, pp. 1-10, Feb. 2022, Art no. 3100410, doi: 10.1109/TMAG.2021.3081042.

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Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement																
	TABLE VI READER ROADMAP TECHNOLOGY CHALLENGES <table><tr><th>Reader Challenges</th><th>Key Issues</th><th>Possible Solutions</th><th>Important Research Projects</th></tr><tr><td>Signal</td><td>MR ~ 100% is required near RA 0.2 ohm.um2 for 2.4 Tbps. (assumes 3dB from TDMR) MR >> 100% is required near RA 0.1 ohm.um2 for 4.0 Tbps. (assumes 3dB from TDMR)</td><td>- Continued optimization of MgO MTJ stack. - Improved/new electrode-barrier/spacer materials and process for increased spin polarization, filtering.</td><td>- Understand Low RA/ high MR limits for practical MgO MTJ. - Optimized materials/ process for improved low RA FeCo/MgO stack. - What's after MgO to meet requirements for RA ~ 0.1, high MR? - Improved/new spacer materials for TMR, GMR with oxide/ metal/ semiconductor spacers and high spin polarization FM (e.g. Heusler) electrodes. - Demo high MR and good uniformity of nano-oxide spacer at 10nm scale.</td></tr><tr><td>Noise</td><td>Thermal magnetic noise increases rapidly with shrinking Freelay (FL) volume Shot Noise and Johnson Noise increase for smaller TMR devices. Preamp noise can be dominant near 1k Ohms</td><td>- Reduce Freelay damping constant - Maximize Freelay saturation magnetization with good anisotropy and low magnetostriction - Improved tunnel barrier quality for reduced Shot noise, lower RA for reduced Johnson noise (TMR). - Low RA, Lower preamp noise.</td><td>- engineered Freelay and cap materials/ interfaces for reduced damping - engineer magnetically soft Freelay materials near 2.4T - see above - develop lower noise preamp for high impedance, high frequency reader (e.g. 1k Ohm, 3 GHz)</td></tr><tr><td>SNR</td><td>In thermal magnetic noise limit, Spin Valve SNR scales as FL Ms x Utilization / damping</td><td>Improved FL materials engineering for high Ms, optimized utilization and low damping. - New device concepts for 4+ Tbps with high SNR</td><td>- engineer Freelay with very high Ms, low damping and soft magnetics. - Fundamental modeling and experimental validation scaling behavior and SNR for NLSV, STO and other promising reader concepts. - Demonstrate stable STO operation at 10 nm scale. Develop/ verify high SNR detection method. Scale design for high linear densities. - Model and characterize scaling of signal/ noise in NLSV to 10nm scale with <10nm thick channel. Develop very high impedance, high freq detector preamp. Evaluate feasibility of Graphene based NLSV.</td></tr></table> Furthermore, the Findings of Fact, Conclusions of law, and Decision in the American Arbitration Association Case No. 651600012907 dated November 18, 2011 (“Arbitration Decision”),¹² state that WD, through wrongful conduct, introduced an MgO TMR head product into the market. The Arbitrator found that: 96. Because of the wrongful conduct by Western Digital and Dr. Mao, Western Digital was able to introduce an MgO TMR head product into the market approximately nine months earlier than they otherwise would have been able to do so. Arbitration Decision at 27.	Reader Challenges	Key Issues	Possible Solutions	Important Research Projects	Signal	MR ~ 100% is required near RA 0.2 ohm.um2 for 2.4 Tbps. (assumes 3dB from TDMR) MR >> 100% is required near RA 0.1 ohm.um2 for 4.0 Tbps. (assumes 3dB from TDMR)	- Continued optimization of MgO MTJ stack. - Improved/new electrode-barrier/spacer materials and process for increased spin polarization, filtering.	- Understand Low RA/ high MR limits for practical MgO MTJ. - Optimized materials/ process for improved low RA FeCo/MgO stack. - What's after MgO to meet requirements for RA ~ 0.1, high MR? - Improved/new spacer materials for TMR, GMR with oxide/ metal/ semiconductor spacers and high spin polarization FM (e.g. Heusler) electrodes. - Demo high MR and good uniformity of nano-oxide spacer at 10nm scale.	Noise	Thermal magnetic noise increases rapidly with shrinking Freelay (FL) volume Shot Noise and Johnson Noise increase for smaller TMR devices. Preamp noise can be dominant near 1k Ohms	- Reduce Freelay damping constant - Maximize Freelay saturation magnetization with good anisotropy and low magnetostriction - Improved tunnel barrier quality for reduced Shot noise, lower RA for reduced Johnson noise (TMR). - Low RA, Lower preamp noise.	- engineered Freelay and cap materials/ interfaces for reduced damping - engineer magnetically soft Freelay materials near 2.4T - see above - develop lower noise preamp for high impedance, high frequency reader (e.g. 1k Ohm, 3 GHz)	SNR	In thermal magnetic noise limit, Spin Valve SNR scales as FL Ms x Utilization / damping	Improved FL materials engineering for high Ms, optimized utilization and low damping. - New device concepts for 4+ Tbps with high SNR	- engineer Freelay with very high Ms, low damping and soft magnetics. - Fundamental modeling and experimental validation scaling behavior and SNR for NLSV, STO and other promising reader concepts. - Demonstrate stable STO operation at 10 nm scale. Develop/ verify high SNR detection method. Scale design for high linear densities. - Model and characterize scaling of signal/ noise in NLSV to 10nm scale with <10nm thick channel. Develop very high impedance, high freq detector preamp. Evaluate feasibility of Graphene based NLSV.
Reader Challenges	Key Issues	Possible Solutions	Important Research Projects														
Signal	MR ~ 100% is required near RA 0.2 ohm.um2 for 2.4 Tbps. (assumes 3dB from TDMR) MR >> 100% is required near RA 0.1 ohm.um2 for 4.0 Tbps. (assumes 3dB from TDMR)	- Continued optimization of MgO MTJ stack. - Improved/new electrode-barrier/spacer materials and process for increased spin polarization, filtering.	- Understand Low RA/ high MR limits for practical MgO MTJ. - Optimized materials/ process for improved low RA FeCo/MgO stack. - What's after MgO to meet requirements for RA ~ 0.1, high MR? - Improved/new spacer materials for TMR, GMR with oxide/ metal/ semiconductor spacers and high spin polarization FM (e.g. Heusler) electrodes. - Demo high MR and good uniformity of nano-oxide spacer at 10nm scale.														
Noise	Thermal magnetic noise increases rapidly with shrinking Freelay (FL) volume Shot Noise and Johnson Noise increase for smaller TMR devices. Preamp noise can be dominant near 1k Ohms	- Reduce Freelay damping constant - Maximize Freelay saturation magnetization with good anisotropy and low magnetostriction - Improved tunnel barrier quality for reduced Shot noise, lower RA for reduced Johnson noise (TMR). - Low RA, Lower preamp noise.	- engineered Freelay and cap materials/ interfaces for reduced damping - engineer magnetically soft Freelay materials near 2.4T - see above - develop lower noise preamp for high impedance, high frequency reader (e.g. 1k Ohm, 3 GHz)														
SNR	In thermal magnetic noise limit, Spin Valve SNR scales as FL Ms x Utilization / damping	Improved FL materials engineering for high Ms, optimized utilization and low damping. - New device concepts for 4+ Tbps with high SNR	- engineer Freelay with very high Ms, low damping and soft magnetics. - Fundamental modeling and experimental validation scaling behavior and SNR for NLSV, STO and other promising reader concepts. - Demonstrate stable STO operation at 10 nm scale. Develop/ verify high SNR detection method. Scale design for high linear densities. - Model and characterize scaling of signal/ noise in NLSV to 10nm scale with <10nm thick channel. Develop very high impedance, high freq detector preamp. Evaluate feasibility of Graphene based NLSV.														

¹² Available at https://amlawdaily.typepad.com/01302012western_interim.pdf.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

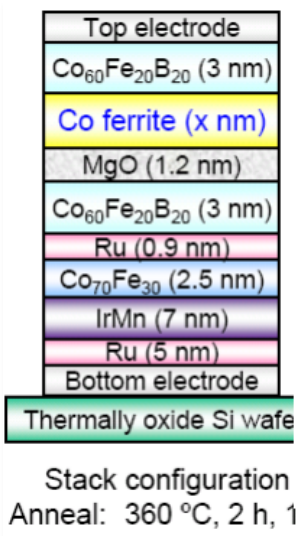
'372 Claim 1	Exemplary Western Digital Infringement
	In addition, the Terris presentation contains a slide titled “Read Head Sensor Technologies” which appears to show that since 2006, a Tunneling MR sensor has a structure that includes a MgO tunnel barrier between a CoFeB layer and a CoFe/NiFe layer.¹³ WD's '006 Patent also illustrates a barrier layer 420 in FIG. 4B that is described as including “MgO with (001) crystalline texture.” '006 Patent, 10:7-13.

¹³ See *supra*, footnote 1 at 22.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	The ferromagnetic nanolayers 413, 431 interface with the barrier layer 420 and promote the crystalline texture of the barrier layer 420, such as a barrier layer that includes MgO with (001) crystalline texture. In one embodiment, which <i>See also '006 Patent, claim 8.</i> 8. The magnetic sensor of claim 1, wherein the barrier layer comprises MgO.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	<i>See also id.</i>, 11:54-57: TiOx, or other suitable electrically insulating materials. In certain embodiments, the barrier layer 420 is formed to a thickness of about 10 Å or less. In some embodiments, the barrier layer is MgO due to the promotion of (001) texture from the CoFe ferromagnetic nanolayers 413, 431 and the boron layers 412, 432. Furthermore, the 2013 presentation by HGST describe a MgO layer.¹⁴ The same presentation cites Dr. Yuasa's 2004 publication in a slide titled "TMR Barrier from Year 2004."¹⁵  Stack configuration Anneal: 360 °C, 2 h, 1

¹⁴ *See infra*, footnote 4.

¹⁵ *See infra*, footnote 4 at 10.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	In the WD Accused Products, the MgO layer has oxygen vacancy, and is an MgO_x layer with ($0 < x < 1$). For example, WD's '006 Patent describes oxygen vacancies in the MgO barrier due to presence of B in the free layer. '006 Patent, 7:54-63. layer 330. For the highest TMR, amorphous CoFeB is commonly used in the free layer to achieve the proper crystallization of an MgO barrier in the sputtered magnetic tunnel junctions; likewise, amorphous CoB can be used to achieve an appropriate TMR. However, the presence of B in the free layer may cause oxygen vacancies in the MgO barrier, which may result in decreased TMR and increased interlayer coupling. Aspects disclosed herein facilitate increased TMR and decreased interlayer coupling even if B is present in the free layer. In addition, in the arbitration between Seagate and WD, on information and belief the Seagate products reflecting its alleged Trade Secret 3 had a MgO barrier layer formed from a tri-layer Mg/MgO/Mg structure; forming the final MgO barrier layer uses an anneal process, which would distribute oxygen atoms throughout the tri-layer structure to form a uniform MgO barrier layer; and this results in oxygen vacancy defects in the MgO barrier layer at least because there are fewer O atoms than Mg atoms in the Mg/MgO/Mg tri-layer structure. Arbitration Decision at 10:

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	<i>Trade Secret 3</i> 19. Seagate asserts that its use of a trilayer barrier layer in a TMR reader constructed by depositing a layer of magnesium (Mg), followed by a layer of magnesium oxide (MgO), followed by another layer of magnesium (Mg) is a trade secret. Seagate further asserts that three to four Seagate employees spent almost two years working on this development and that its use of a trilayer barrier layer significantly improved the performance of its reader, resulting in signal-to-noise and yield improvements. 20. In June 2007, Seagate made public its use of an Mg/MgO/Mg barrier layer in a TMR reader. At that time, a patent application Seagate filed with the United States Patent and Trademark Office that disclosed this use was published. In addition, in May 2007, a patent application Headway Technologies, Inc. filed with the United States Patent and Trademark Office that disclosed the use of “a tunnel barrier having a Mg/MgO/Mg configuration” was published. Furthermore, in that arbitration Seagate contended WD had used Seagate’s alleged tri-layer “secret,” indicating that WD’s HDDs copied Seagate’s tri-layer Mg/MgO/Mg structure.¹⁶

¹⁶ In the Arbitration Decision, the arbitrator did not reach the issue of whether WD misappropriated the alleged tri-layer trade secret (Trade Secret 3) because of a finding that Seagate did not adequately prove alleged Trade Secret 3 qualified for trade secret protection. Arbitration Decision at 10-11. Nothing in the Arbitration Decision indicates that WD proffered any evidence that its design did not use the tri-layer structure, however.

EXHIBIT F
Claim Chart for U.S. Patent No. 11,737,372 and Western Digital

'372 Claim 1	Exemplary Western Digital Infringement
	WD has also disclosed its use of a MgO tunnel barrier in its read/write heads, as discussed above regarding the previous limitation and incorporated here.