

EXHIBIT M

Infringement of U.S. Patent No. 11,721,714

ISOCELL Image Sensor S5K2LD
Samsung Galaxy Z Flip5

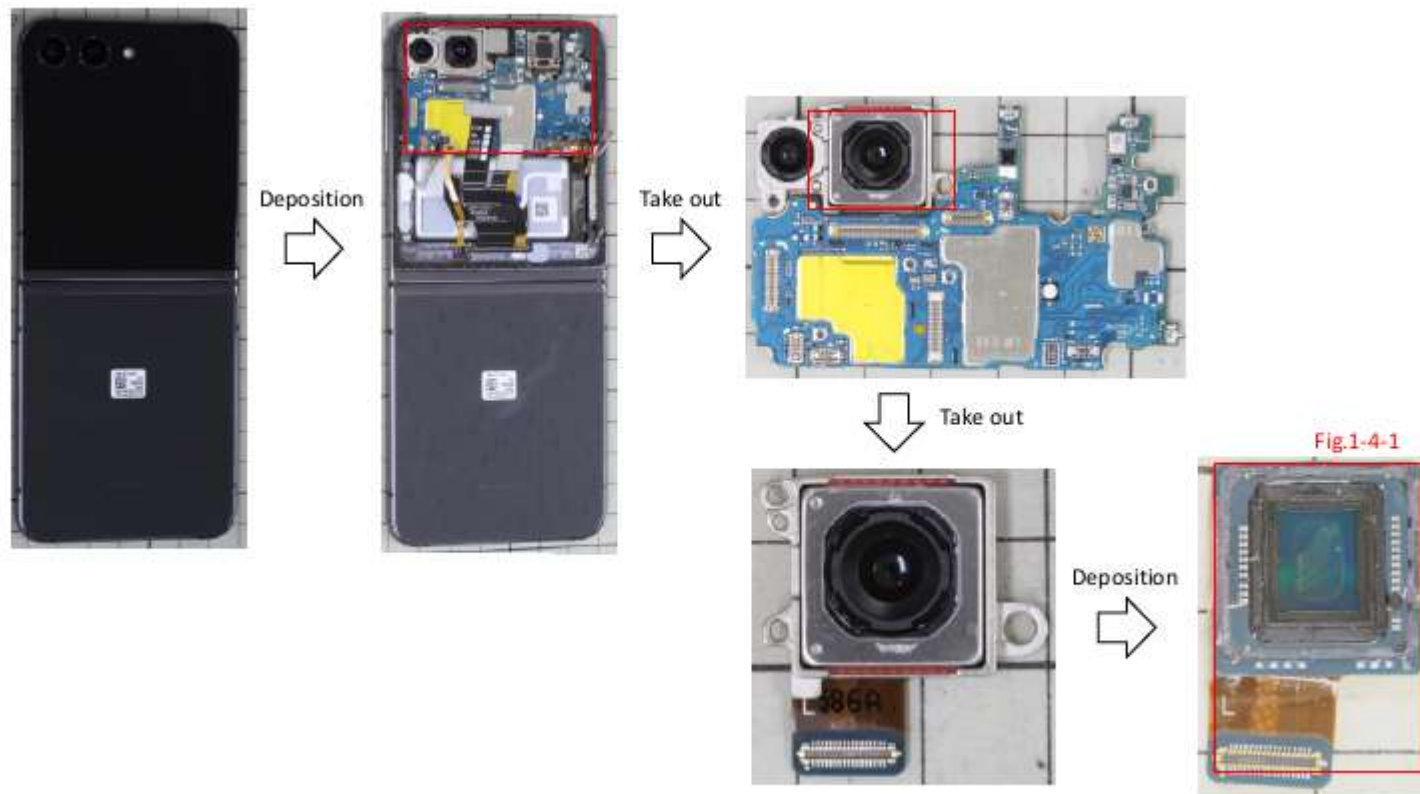
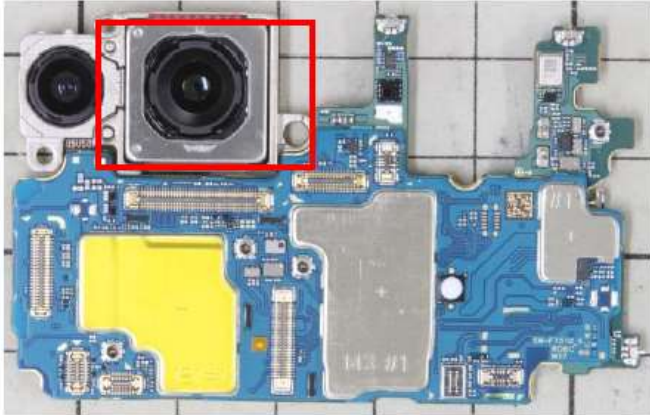
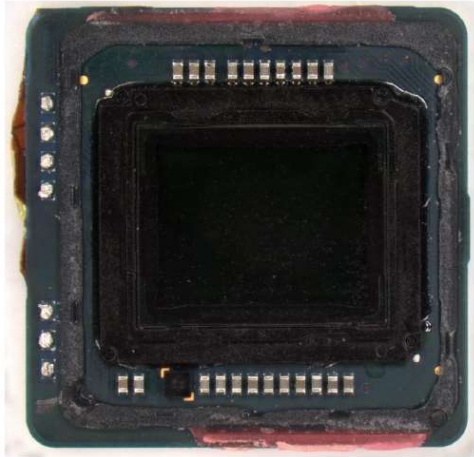


Fig. 1-3-1 Deposition process

Claim 1: A light trapping device, comprising:

Claim 1	
A light trapping device, comprising:	<p data-bbox="468 201 1902 233">The Samsung Galaxy Z Flip5 is a light trapping device at least because it includes a Samsung ISOCELL sensor.</p> <p data-bbox="468 266 1703 298">The images below show the Samsung S5K2LD image sensor from the Samsung Galaxy Z Flip5.</p> <div data-bbox="606 409 1251 821"></div> <div data-bbox="1276 354 1747 808"></div> <p data-bbox="1392 824 1692 846">Fig. 2-1-1 Image sensor appearance (Front)</p>

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Claim 1: A light trapping device, comprising:

Claim 1

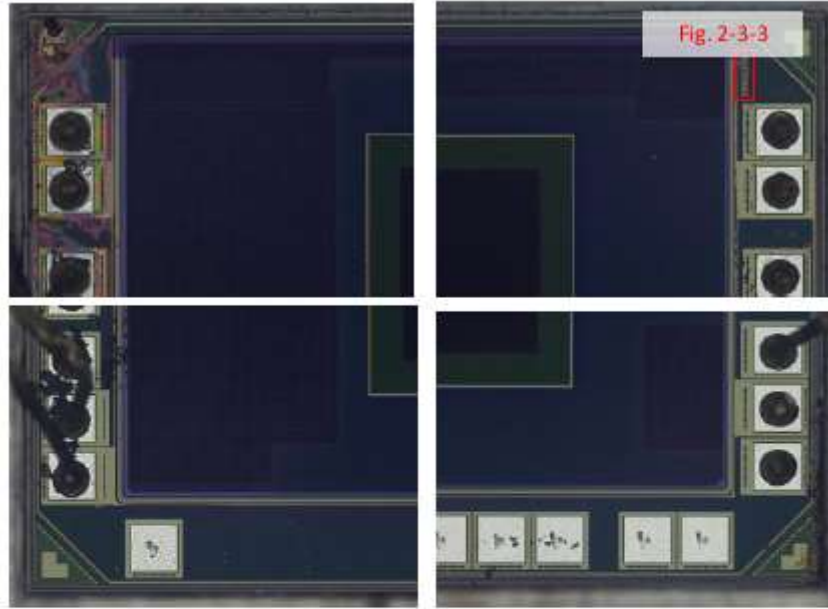


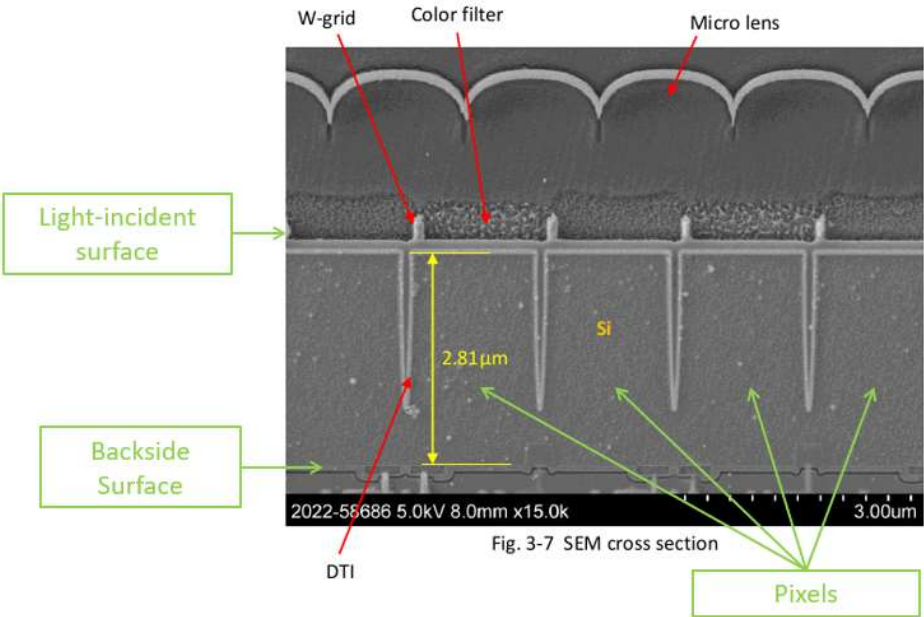
Fig. 2-3-2 Die corner



Fig. 2-3-3 Die marking (OM)

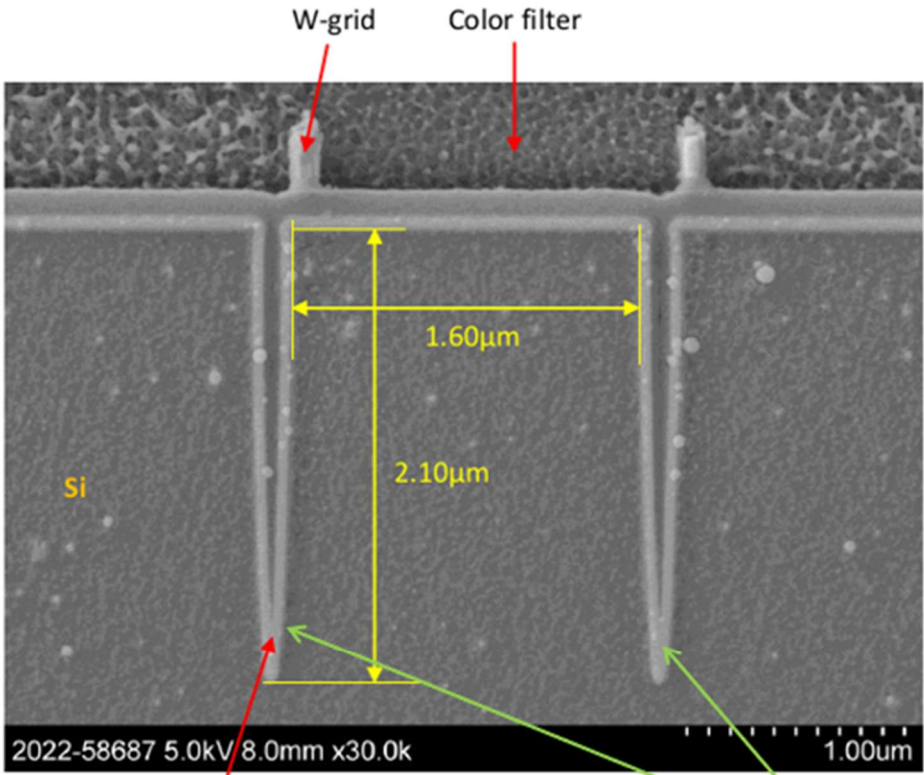
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Claim 1(a): at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;

Claim 1(a)	
<p>at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;</p>	<p>The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery.</p> <p>The scanning electron microscope (“SEM”) cross sections below show light sensitive pixels of the ISOCELL sensor. Further, the images below show a light incident surface and a backside surface, opposite the light incident surface. In addition, the images below show cross sections of the peripheral sidewalls, which extend into at least a portion of the pixel.</p>  <p>Fig. 3-7 SEM cross section</p>

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Claim 1(a): at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;

Claim 1(a)	
	 <p>The SEM cross-section image shows a pixel structure on a silicon (Si) substrate. A central pixel area is defined by a width of 1.60μm and a depth of 2.10μm. The structure is topped by a W-grid and a Color filter. A DTI (Deep Trench Isolation) feature is shown on the left side of the pixel. A green box labeled 'Peripheral Sidewalls' points to the vertical walls of the pixel. The image includes a scale bar of 1.00μm and technical data: 2022-58687 5.0kV 8.0mm x30.0k.</p> <p>Fig. 3-8 SEM cross section</p>

Claim 1(a): at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;

Claim 1(a)

The top-view of the ISOCELL sensor, shows that the peripheral sidewalls substantially surround the pixel periphery.

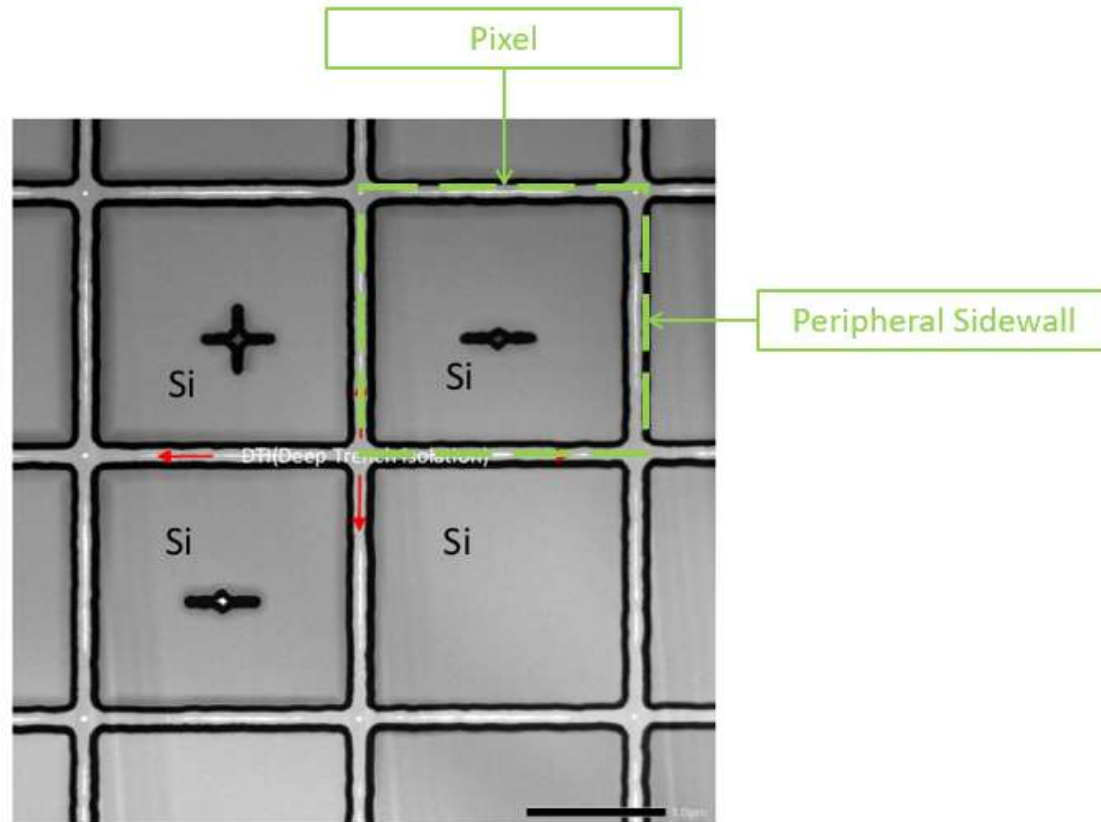
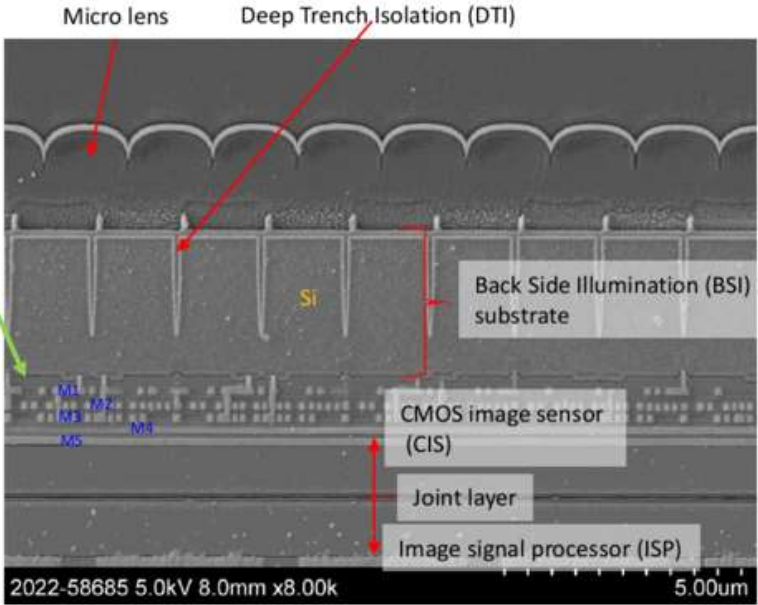


Fig. 4-2 BF STEM image

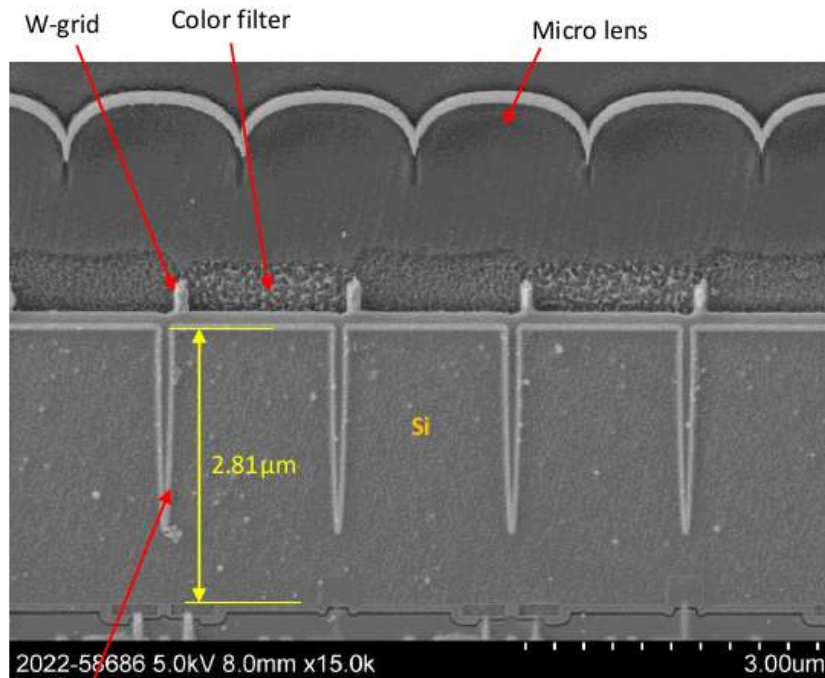
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Claim 1(b): a backside light trapping material at least partially covering the backside surface; and

Claim 1(b)	
a backside light trapping material at least partially covering the backside surface; and	<p>The ISOCELL from the Samsung Galaxy Z Flip5 includes a backside light trapping material substantially covering the backside surface.</p> <p>The SEM images below show that the backside surface is substantially covered by backside light trapping material.</p> <div><div>Backside light trapping material</div><p>The SEM cross-section image shows the following layers from top to bottom: Micro lens, Deep Trench Isolation (DTI), Back Side Illumination (BSI) substrate, CMOS image sensor (CIS), Joint layer, and Image signal processor (ISP). A green box labeled 'Backside light trapping material' points to the BSI substrate layer. The image also shows a Si layer and various metal layers (M1, M2, M3, M4, M5). The scale bar at the bottom right indicates 5.00um.</p></div> <p>Fig. 3-6 SEM cross section</p>

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Claim 1(c): a peripheral light trapping material substantially covering the peripheral sidewall;

Claim 1(c)	
<p>a peripheral light trapping material substantially covering the peripheral sidewall;</p>	<p>The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes a peripheral light trapping material substantially covering the peripheral sidewall.</p> <p>As shown in the SEM cross-section below, the ISOCELL sensor includes peripheral light trapping material substantially covers the peripheral sidewall.</p> <div data-bbox="787 422 1606 1169">  <p>W-grid</p> <p>Color filter</p> <p>Micro lens</p> <p>Si</p> <p>2.81µm</p> <p>2022-58686 5.0kV 8.0mm x15.0k</p> <p>3.00µm</p> <p>DTI</p> <p>Fig. 3-7 SEM cross section</p> </div>

Claim 1(c): a peripheral light trapping material substantially covering the peripheral sidewall;

Claim 1(c)

As shown in the energy dispersive X-ray spectroscopy below, the peripheral sidewall in the ISOCELL sensor is covered with a peripheral light trapping material, comprised of silicon, silicon oxide, hafnium oxide, aluminum oxide, and a void.

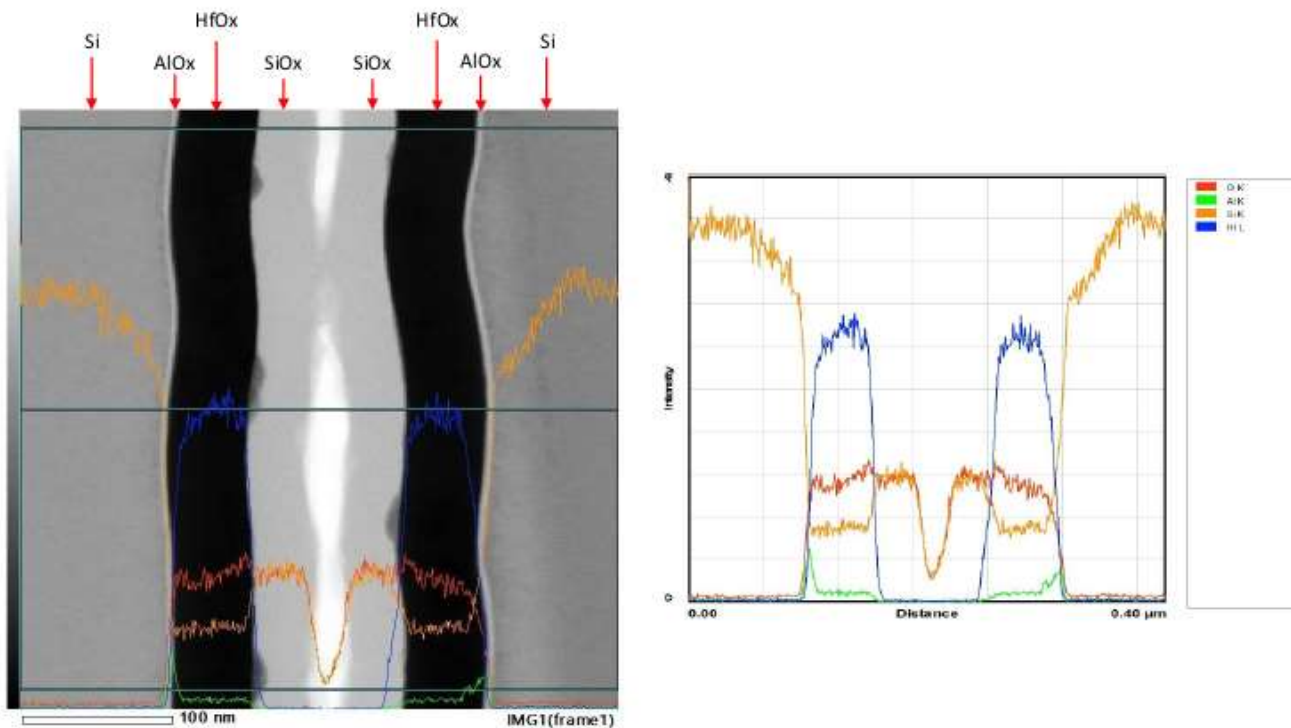


Fig. 6-1 Raw test data (number of atoms detected)

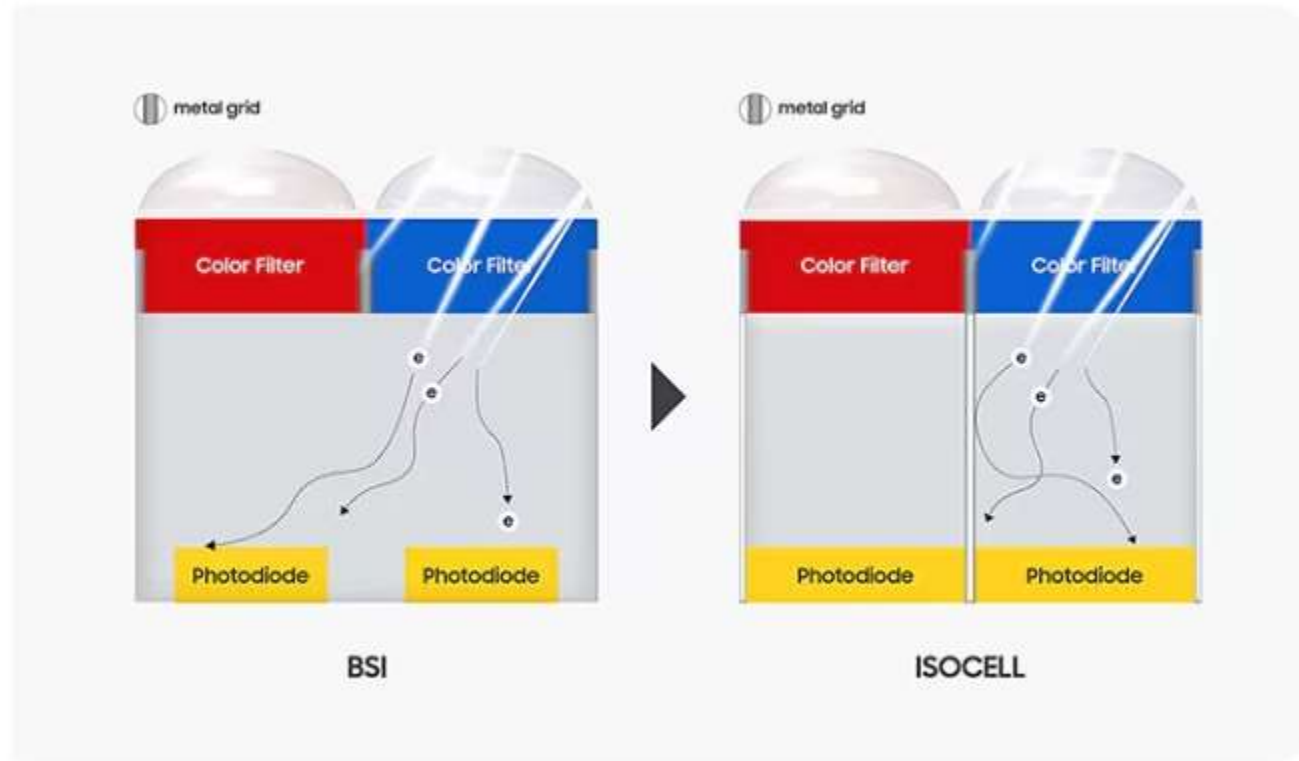
Claim 1(d): wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel;

Claim 1(d)

wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel;

The ISOCELL sensor from the Samsung Galaxy Z Flip5 is a sensor wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel.

As shown below, light contacting the peripheral light trapping material will be reflected back toward the pixel in Samsung's ISOCELL devices.



ISOCELL Plus: Leading the next generation of image sensors, Samsung Corp., <https://semiconductor.samsung.com/news-events/tech-blog/isocell-plus-leading-the-next-generation-of-image-sensors/> (last visited March 5, 2024)

Claim 1(e): wherein at least one of the backside light trapping material or the peripheral light trapping material includes a high refractive index material sandwiched between two low refractive index materials.

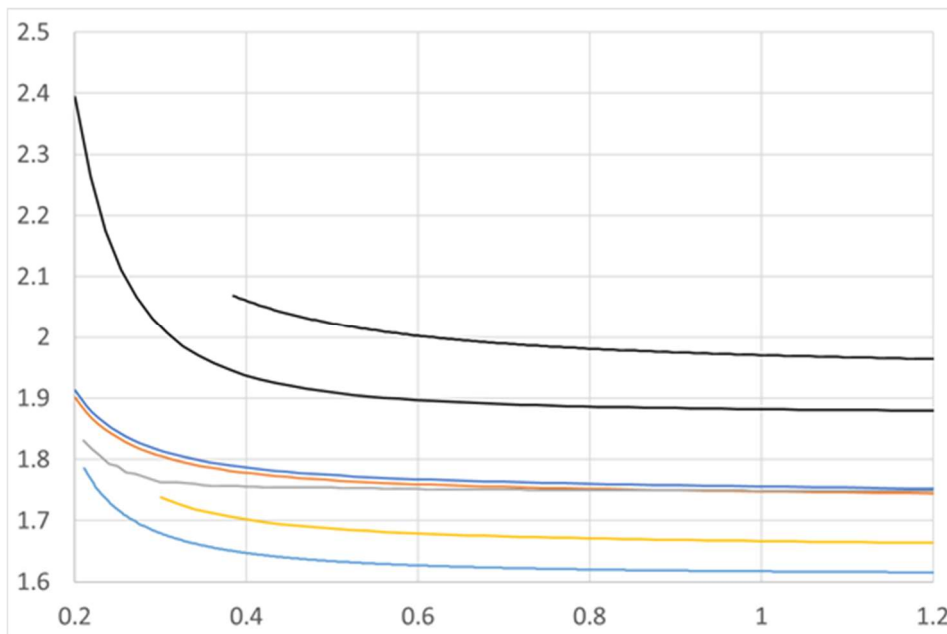
Claim 1(e)	
<p>wherein at least one of the backside light trapping material or the peripheral light trapping material includes a high refractive index material sandwiched between two low refractive index materials.</p>	<p>The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes a peripheral light trapping material substantially covering the peripheral sidewall, wherein at least one of the backside light trapping material and the peripheral light trapping material includes a high refractive index material sandwiched between two low refractive index materials.</p> <p>As shown by the graph in the image below, the peripheral light trapping material is comprised of, for example, HfOx sandwiched between SiOx and AlOx.</p> <div data-bbox="554 527 1837 1250"> <p>The figure consists of two parts. On the left is a cross-sectional EDX spectrum showing intensity versus distance. The spectrum shows several peaks corresponding to different elements: O K (red), Al K (green), Si K (orange), and Hf L (blue). The peaks are labeled with their respective element symbols and line types. On the right is a line graph showing intensity versus distance. The graph has four data series: O K (red), Al K (green), Si K (orange), and Hf L (blue). The x-axis is labeled 'Distance' and ranges from 0.00 to 0.40 μm. The y-axis is labeled 'Intensity'. The graph shows several peaks corresponding to the elements, with the Hf L peak being the most prominent. A scale bar of 100 nm is shown at the bottom left of the cross-section. The label 'IMG1(frame1)' is at the bottom right of the cross-section.</p> </div> <p>Fig. 6-1 Raw test data (number of atoms detected)</p>

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Claim 1(e): wherein at least one of the backside light trapping material or the peripheral light trapping material includes a high refractive index material sandwiched between two low refractive index materials.

Claim 1(e)

The index of refraction for hafnium oxide (black curves) greater than aluminum oxide (colored curves).



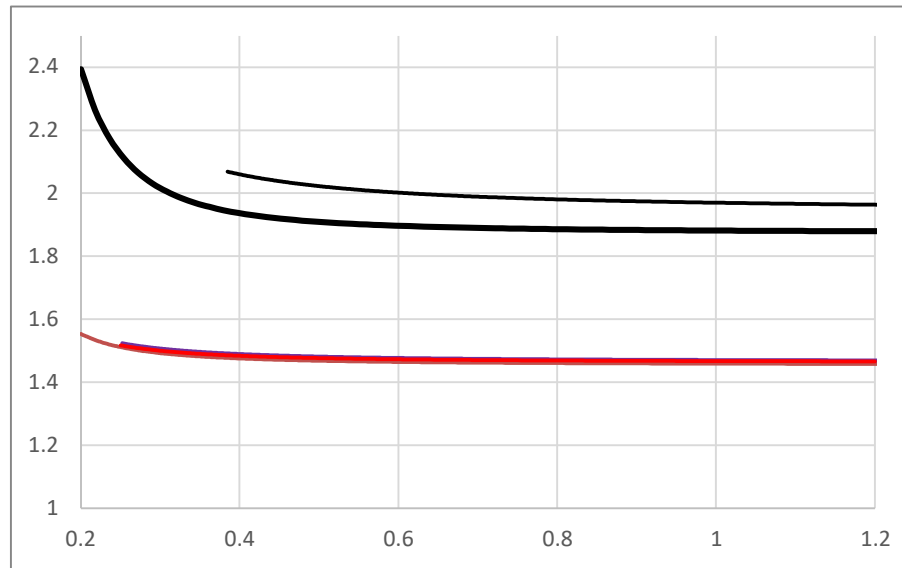
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Claim 1(e): wherein at least one of the backside light trapping material or the peripheral light trapping material includes a high refractive index material sandwiched between two low refractive index materials.

Claim 1(e)

The index of refraction for hafnium oxide (black curves) is likewise greater than the index of refraction for silicon dioxide (colored curves).



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