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Air tightness vs Water tightness

·  thierry2506 ·  Nov 5, 2006 ·  [Air](#) [Water](#)

Nov 5, 2006

 #1**thierry2506**  :1 :0

Hi,

I am currently making test under vacuum and pressure to define sealing performance of a device. Test are made at +/- 0.5 bars.

The result I find is that the device tested is water sealed but not air sealed.

Is there any physics law showing that a water sealing performance at 0.5 bars will have an air equivalent sealing performance much lower ?

Why a sealing performanc vacuum test, weither made under water or air is more severe than a pressure test ?

Hope somebody can help !

Regards

Thierry



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Nov 6, 2006

 #2**actionintegral**:305: 5

Is it possible that the viscosity of the water is preventing the water from getting into the container?

Nov 14, 2006

 #3**jasc15**:162: 5

water molecules are simply larger than air molecules.

And what do you mean +/- 0.5 bar? 0.5 bar is approximately 0.5atm, which is by no means a strong vacuum

Nov 14, 2006

 #4**actionintegral**:305: 5

jasc15 said:

water molecules are simply larger than air molecules.

Really? I would have guessed that O₂ and H₂O would be similar in size. But the H₂O would be more polar.

Nov 14, 2006

 #5**NateTG**:2,449 Science Advisor Homework Helper: 7

Well, I'm pretty sure that water vapor would also get through the gaps just fine.

I expect that if you oil or wax the interior of your vacuum vessel, it's going to be much more airtight as well.

I think (and this is just wild speculation, really) that the primary reason that the a vessel is watertight, but not air tight (and other gasses) is capillary action: Consider that the gaps are very narrow, which means that the capillary effect is very strong, and, simultaneously, that the force due to pressure difference is very small. Depending on what you're doing, you might be able to test this hypothesis by adding a surfactant to the water, and seeing if the vessel is still watertight.

Nov 15, 2006

 #6**actionintegral**:305: 5

$\int$ What's a surfactant? dx

Nov 15, 2006

 #7**NateTG**:2,449 Science Advisor Homework Helper: 7

actionintegral said:

$\int$ What's a surfactant? dx

A surfactant is something that breaks up surface tension. The most familiar example is soap.

<http://en.wikipedia.org/wiki/Surfactant>

Nov 15, 2006

 #8

ChemGuy

:24

: 0

Viscosity and size are both the problem. Water does not exist as H₂O but as a much larger collection of water molecules. This is why water has a much higher boiling point than a molecule of that weight would suggest. This is caused by hydrogen bonding between water molecules. Because they are stuck together in groups the material is also more viscous than you would expect. This makes the practical size of the molecule much bigger. It may also have to do with polarity and "sticking" to the walls of the sealing material (this is just a guess).

A vacuum test and a pressure test are not equivalent even under the same pressure differentials. There are many factors that effect the sealing between two surfaces, the least of which is the gasket. The design of the mating surfaces are paramount. There are many surfaces that are designed to leak in one direction but not the other. Pump seals are a prime example. Some of them are designed to allow a small amount of liquid (gas) to be sucked into the pump but nothing out. This assures that a leak is controlled in certain manner.

Also remember that the highest delta P you can get from a vacuum test is 1 ATM while a pressure test can go much higher.

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