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Hydrates under pressure – new insights from sulfuric acid hydrates

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Hydrates are a rich and diverse class of materials that display a wide range of structures and properties – a feature that is only exaggerated when they are subjected to high-pressures. Consequently, these have implications on our understanding of many outer solar system bodies, where hydrates are amongst the dominant materials found there.

For Europa and Ganymede, two moons under intense investigation from past and future space missions, their surfaces seen to be mostly water-ice and hydrates. Despite the apparent 'simplicity' of these materials, we still observe very complex geological formations on these moons – including subduction [1]. Hence, we need to understand the transformations of candidate surface materials under a range of pressure/temperature conditions in order to accurately explain the formations on these icy surfaces.

One hydrate candidate material for the surfaces of these moons are sulfuric acid hydrates, formed from radolytic sulfur (from Io) reacting with the surface ice. Sulfuric acid hydrates have already been established to have a complex phase diagram with composition [2].

We have now used the Mito cell [3] at the PLANET instrument [4] to undertake the first investigation of the high-pressure behavior of the water rich sulfuric acid hydrates. Compressing at 100 K and 180 K we see that the hemitriskaidekahydrate becomes the stable water-rich hydrate and observe some interesting relaxation behaviour in this material at pressure, which could have significant consequences for the interiors of Ganymede.

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