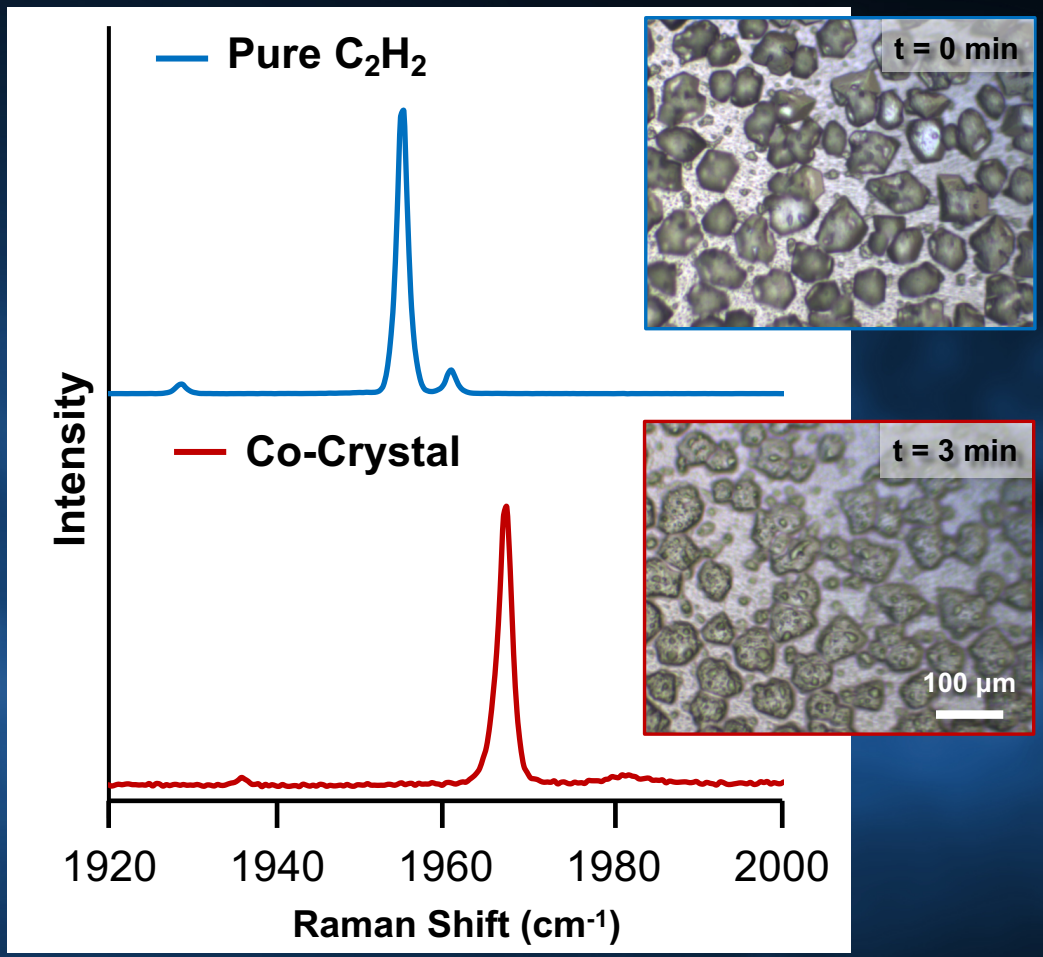
A New Mineral that May be Abundant on Titan



The top trace (blue) is the Raman shift for the C≡C stretch of acetylene (C_2H_2). On formation of the co-crystal with butane, this shifts by 12 wavenumbers (cm^{-1}) as seen in the bottom trace (red), indicating that the acetylene molecule is in a different environment. The morphology of the crystals also changes (images, right).

Background: Titan hosts a complex chemical engine producing a rich inventory of organic molecules in its thick atmosphere and on its surface where modeling suggests that acetylene and butane would be the main components of evaporite deposits. On Titan's cold and organic-rich surface, organic molecules can associate in a manner akin to minerals on Earth, forming molecular solids, co-crystals, and hydrates.

Data & Results: Researchers have discovered a new co-crystal in the laboratory using Raman spectroscopy. Comprised of acetylene and butane, it forms readily at 130 K and is stable at Titan surface temperature (90 K).

Significance: Unlike other co-crystals discovered previously, the acetylene-butane co-crystal is made up of two compounds that are believed to be abundant on Titan's surface. Therefore, this molecular mineral may be ubiquitous on Titan, in particular in and around the dried hydrocarbon lakebeds in the polar regions.

Cable M. L., Vu T. H., Malaska M. Maynard-Casely H. E., Choukroun M., and Hodyss R. (2019) A co-crystal between acetylene and butane: A potentially ubiquitous molecular mineral on Titan. *Earth and Space Chemistry*, accepted.
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