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Serpentinization of amorphous silicate in the solar system : A nanoscale experimental study.

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Serpentine is ubiquitous in carbonaceous chondrites [1] and reflects hydration episodes which may occur either in the solar nebula [2] or in the asteroidal parent body [1], where reaction temperatures and timescales are drastically different.

We initiated an experimental study of the mechanisms and kinetics of hydration reactions using a novel experimental setup and coupled analytical techniques. A micron-thick layer of amorphous silicate (~ Fayalite 50) is deposited on a Al_2O_3 substrate and heated in teflon bombs together with water (60°C to 200°C, several days). We then combine analyses by TEM, Rutherford Back Scattering (composition) and Nuclear Resonance Analysis (H at.%). Preliminary results reveal the formation of a sequence of layers : hydrated silicon oxide on top, followed by amorphous material of Mg-serpentine and Fe-serpentine composition separated by iron oxide. The hydration kinetics could ultimately help unraveling the history of water-bearing phases in the solar system.

[1] Brearley A.J. (2006) MESS II , 587–624. [2] Ciesla et al., (2003) Science 299, 549–542.

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