Silicate nanometric dust production and characterization and its use as interstellar grain analogs to simulate the formation of H_2

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Silicate grains as an important fraction of dust in the general diffuse interstellar medium (ISM) are of great interest to astrophysicists. Silicate surfaces allow the recombination of the most abundant molecule, H_2, which drives further chemical complexity. Their properties depend on their location and lifetime in the ISM, where they can be irradiated by energetic photons and ions.

Nanometre-sized silicate samples (forsterite and fayalite, Mg_2- or Fe_2- SiO4 end-members of the olivine family) are prepared (with both amorphous and micro-crystalline structure) in the laboratory via laser ablation.

These silicates are carefully characterized using high-resolution transmission electron microscopy (HRTEM), energy-dispersive X-ray spectroscopy (EDX), scanning electron microscopy (SEM) and atomic force microscopy (AFM), building a bridge to the morphology, structure, and chemical composition of dust, just condensed and subsequently processed [1].

They are then used as surface catalysts in molecular hydrogen formation experiments within the FORMOLISM setup. The aim is to explore the direct effect of these different dust species on H_2 formation and the ensuing formation energy partition. In addition to a summary of previous results [2-8], we will present (in a joint poster) preliminary results on H_2 formation on such silicates and the dependence on temperature, possible nuclear spin conversion effects, and rotationally "hot H_2".

Such a study provides a major link to astronomical observations as a tool for identification of cosmic dust properties.

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