Synthesising Silica and Silicate from Atomic Constituents: Steps Toward a Model System for Experimental Studies of Interstellar Silicates at the Atomic Level

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Interstellar dust grains play an important role in the evolution of the interstellar medium (ISM), including acting as catalytic surfaces for chemical reactions that are inefficient in the gas phase [1]. As such, an understanding of dust grain chemistry at the atomic level is essential in the goal of elucidating the gas-grain interactions of the ISM.

Here we report on scanning tunneling microscopy (STM) and X-ray photoelectron spectroscopy (XPS) measurements on interstellar silicate dust grain model surfaces. In astrochemistry, several STM studies have already been conducted on dust grain chemistry, utilising highly oriented pyrolytic graphite (HOPG) or polycyclic aromatic hydrocarbons as model systems for carbonaceous dust grains [2-4]. However, experimental atomistic studies into chemical reactions on silicate surfaces, another prime component of the interstellar dust population, are highly limited by the insulating nature of silica and silicates.
In recent years, the growth of well-defined two-dimensional silica films have been reported on various metal substrates [5]. While these films are compatible with experimental surface science techniques, the underlying metal substrates are broadly catalytically active, making them a possible complication when conducting chemical studies within astrochemistry.

We demonstrate the growth of silicon dioxide and silicate films on HOPG from their atomic constituents and characterise these using STM and XPS. The resulting films have future applications as substrates for studies of interstellar catalytic reactions.

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