Sticking of dust / micrometeorite particles on to ices at high impact velocities - Implications for astrochemical ice enrichment

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Abstract: Impact events are inevitable till date both within the inner and outer regions of the Solar System. Such impact events dominate the surface modifications of most of the airless bodies. Regardless of the destructive nature of impact events, the birth of few moons in the Solar System are known to be the by-products of impacts. Moreover, particle aggregation from relatively low velocity impacts (from nm to μm sized dust particles) are thought to be the reason behind the growth of planetesimals[1]. While considering impact events in the colder regions of the Solar System the role of molecular ices in planetesimal aggregation cannot be neglected. Therefore, to understand the role of such small particle impacts over icy bodies, we investigated sticking of dust particles on to CO_2 ices in the higher velocity impact regime, 100-300 ms^{-1} using a modified hand driven shock tube (Reddy Tube). Grains of brick, basalt and powdered turmeric, graphite and fullerene soot particles were fired on to the CO_2 ice targets. Meteorite samples (Sulagiri and Allende) were used to mimic the real micrometeorite impacts on to dry ice. The particles of different sizes and impact angle are found to significantly affect the sticking pattern. The impact area was observed to be coated by the impacting material. Lesser micron sized particles were observed to penetrate into the ice layers. Results suggest that astrochemical ices are chemically enriched by high velocity micrometeorite impacts.

References:

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