Chemistry Induced by Simulated Impact Shocks on Ices: Application to Icy Satellites

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Recently, impact processing has been considered as a possible energy source for organic synthesis in ices (Borucki *et al.*, 2002; McDonald *et al.*, 1996). There is a great interest in meteorite impacts on icy surfaces of the satellites of Jupiter and Saturn because their ice crusts may contain contaminants as carbon, oxygen, and nitrogen-bearing compounds (Cruishank *et al.*, 1993, 1997, 1998) that could induce various chemical reactions and participate in synthesizing prebiotic molecules.

Here we investigate by laboratory experiments the possible contribution of meteorite impact as an energy to drive chemical reactions in icy surfaces. Shocks during impacts are simulated by energy deposition from a pulsed Nd-YAG laser emitting at 1064 nm with an energy of 200 mJ/pulse. We have conducted a series of experiments irradiating different ice mixtures at 77K under vacuum. GC-MS and IRTF analytical techniques were used to detect and identify the volatile products of the irradiated ices. We discuss the impact shock induced formation of newly formed molecular species.

In our study, we also consider the possibility that impacts and laser pulses could be used to eject material from an icy surface for analysis by an orbiter. Our simulation can be used to determine the decomposition of organics in the ices as a result of such ejection mechanisms.