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Laboratory simulation of sputtering dust grains in the solar wind

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Dust grains in space are exposed to energetic ions, electrons and UV irradiation. An impact of energetic ions can lead to sputtering of the grain resulting, consequently, in a grain destruction during long-term exposures to space environment.

In the solar wind, dust grains are bombarded by ions and electrons simultaneously and it is known that an impact of electrons can influence the sputtering yield of glass material during the ion bombardment. This mechanism preferentially sputters oxygen and we suggest that it could be valid for silicate-type grains as well. For the presented simulation, we have chosen spherical SiO_2 grains with diameter in the range of 1 micron. Our experimental set-up enables us to catch and to store a single dust grain which can be simultaneously influenced by argon ions with an energy of 2 keV and by 1 keV electron beam. The mass of the grain is determined after each bombardment session (approx every 3 hours) and we can judge the sputtering efficiency from temporal changes of the mass.

Although the 2 keV Ar^+ and 1 keV e^- beams are only rough representatives of solar wind conditions, the results can give us some conclusions on the electron influence on the sputtering rate in space.