A Comparison of Solar Wind Hydroxylation within and outside Lunar Magnetic Anomalies

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We describe the diffusive outgassing of hydrogen initially implanted by the solar wind into exposed soils on the Moon. The formalism applies a statistical mechanics approach similar to that applied recently to molecular adsorption onto activated surfaces. The key element enabling this formalism is the recognition that the inter-atomic potential between the implanted H and regolith-residing oxides is not of singular value, but possess a distribution of trapped energy values at a given temperature, $F(U, T)$. All subsequent derivations of the outward diffusion and H retention rely on the specific properties of this distribution. We find that solar wind hydrogen can be retained if there are sites in the implantation layer with activation energy values exceeding 0.5 eV. We especially examine the dependence of H retention applying characteristic energy values found previously for irradiated silica and mature lunar samples. We apply the formalism to grains in magnetically unshielded (nominal) lunar regolith and will compare the results to grains in magnetic anomaly regions where lower energy ions are incident with the surface. In magnetic anomalies, H retention is found to be reduced due to the reduced ion flux and shallower depth of implantation.