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Chemical Interactions in Low Earth Orbit

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Although several observations of material changes on-orbit have been reported, mechanistic understanding has not yet become clear because new sets of non-intuitive processes are occurring on orbit. Reactant kinetic energy, low collision rates and surface/adsorbate interactions must be considered in the analysis of these observations. The specific example of oxide formation of elemental materials will be examined in terms of thermodynamics and possible reaction pathways. On the basis of this approach, a rational trend emerges from the orbital behavior of these samples. The role of reactant kinetic energy as opposed to internal energy in chemiluminescent product formation will also be presented. Development of a systematic thermochemical approach may be useful in making screening predictions of long-term material behavior on-orbit.