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Light-fueled High Energy Reactions Enabled by Diamond[1]
TIRZAH FOUGNER, JONATHAN BARKL, FRANZ KOCECK, ANNA ZANIEWSKI, ROBERT NEMANICH, Arizona State University — The enormous power available from the sun has the potential to not only supply electricity, but also fuel high energy chemical reactions that currently depend on fossil fuels to achieve the required high pressure and temperature. In this project, we utilize unique properties of diamond in conjunction with ultraviolet and visible sources of light to generate electrons solvated in water. Enabling this electron generating process is the negative electron affinity of the hydrogen-terminated diamond surface. These electrons are used to fuel the high energy reaction of breaking the nitrogen-nitrogen bond and reducing nitrogen to ammonia. This process could also be used to reverse combustion to make fuels from carbon dioxide. Our results confirm that ammonia is produced by this mechanism from nitrogen gas using both visible and ultraviolet light.

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