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APPLIED SCIENCES AND ENGINEERING

Dissociating stable nitrogen molecules under mild conditions by cyclic strain engineering

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All quiet on the nitrogen front. The dissociation of stable diatomic nitrogen molecules (N_2) is one of the most challenging tasks in the scientific community and currently requires both high pressure and high temperature. Here, we demonstrate that N_2 can be dissociated under mild conditions by cyclic strain engineering. The method can be performed at a critical reaction pressure of less than 1 bar, and the temperature of the reaction container is only 40°C. When graphite was used as a dissociated N* receptor, the normalized loading of N to C reached as high as 16.3 at/at %. Such efficient nitrogen dissociation is induced by the cyclic loading and unloading mechanical strain, which has the effect of altering the binding energy of N, facilitating adsorption in the strain-free stage and desorption in the compressive strain stage. Our finding may lead to opportunities for the direct synthesis of N-containing compounds from N_2.