Steric effects in the chemisorption of vibrationally excited methane on nickel

Yoder, Bruce L., author

Abstrak

Bruce Yoder’s thesis outlines his investigation of the dissociative chemisorption of methane (CH4) on a nickel single crystal. In this work Bruce uses a molecular beam and infrared laser techniques to prepare methane in excited rovibrational states. The excited methane molecules are aligned relative to the target nickel surface. Bruce describes the discovery and exploration of a previously unknown steric effect in the dissociation reaction between a vibrationally excited methane molecule and a nickel crystal. From these studies we see that methane molecules are up to twice as reactive when the vibration is aligned parallel rather than perpendicular to the surface. This discovery will help guide the development of detailed predictive models of methane chemisorption, which in turn may lead to better catalysts for the synthesis of several industrially relevant chemicals, including hydrogen fuel from natural gas.