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Daniel Halwidl

Development of an Effusive Molecular Beam Apparatus

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Daniel Halwidl

Abstract

This thesis describes the development of an effusive molecular beam apparatus, which allows the dosing of gases, liquids and solids. The apparatus was designed to adsorb precise and reproducible doses to a defined area on metal oxide samples, which is required in Thermal Programmed Desorption and other surface chemistry experiments in the “Machine for Reactivity Studies”. The theoretical profile of the molecular beam has a core diameter of 3.5 mm and a standard core pressure of 4×10^{-8} mbar, while the background pressure of the beam is 4 orders of magnitude lower. The design and the construction of the apparatus is described. The calculated beam profile was experimentally confirmed and core pressures between 1.7×10^{-8} mbar and 2.9×10^{-6} mbar were measured.

Kurzfassung

Diese Diplomarbeit beschreibt die Entwicklung einer effusiven Molekularstrahlapparatur für die Adsorption von Gasen, Flüssigkeiten und Feststoffen auf Metalloxidproben in der “Machine for Reactivity Studies”. Die Adsorption einer präzisen, reproduzierbaren Dosis auf einem wohldefinierten Bereich der Probenoberfläche ist für Thermische Desorptionsspektroskopie und andere Methoden der Oberflächenchemie notwendig. Das berechnete Profil des Molekularstrahls weist einen Kern mit Durchmesser 3.5 mm und einen Standarddruck von 4×10^{-8} mbar auf, während der Hintergrunddruck des Molekularstrahls um 4 Größenordnungen kleiner ist. Der Entwurf und die Konstruktion des Apparats sind beschrieben. Das berechnete Profil wurde experimentell bestätigt und ein Druck von 1.7×10^{-8} mbar bis 2.9×10^{-6} mbar im Kern des Molekularstrahls gemessen.

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