Measurement of Chemical Reaction Rates on Surfaces via X-ray Fluorescent Fluctuation

Morrel H. Cohen
Exxon Research and Engineering Co., Annandale, NJ 08801

The surface diffusion coefficients of adsorbates on field-emission tips have been extracted from the autocorrelation function of the fluctuating field emission current. The technique works because of the relatively large concentration fluctuations within the small area of the tip. An analogous measurement of the time dependence of the fluctuating intensities of the x-ray fluorescences from all reacting species present on a surface would in principle make possible the extraction of reaction rates and adsorption and desorption rates as well as the diffusion coefficients from the auto- and cross-correlation functions of the intensities. For the fluctuations to be large enough to ensure feasibility, only a very small area must be illuminated by the incident x-ray beam. Thus the proposed technique would require a beam of very high brilliance. For reactions involving light elements, e.g. hydrocarbons, the soft-x-ray domain would be relevant. The proposed method will be illustrated by discussion of surface diffusion and of a simple reaction.