

**NOVEL IN SITU RADIOTRACER METHODS FOR THE DIRECT AND INDIRECT STUDY OF CHROMATE ADSORPTION ON ALUMINA****L. Gáncs,<sup>1</sup> Z. Németh<sup>2</sup>, and G. Horányi<sup>3</sup>**<sup>1,2</sup>*Department of Radiochemistry, University of Veszprém,  
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The application of radiochemical techniques for the investigation of solid – solution interface involves the study of a wide range of fundamental phenomena including the study of the specific adsorption of various species on powdered oxides.

The better understanding of sorption behaviour of  $\text{CrO}_4^{2-}$  ions on  $\gamma\text{-Al}_2\text{O}_3$  is a crucial issue in many branches of applied surface science such as heterogeneous catalysis or corrosion protection. In order to get reliable information on adsorption and generally on surface phenomena the application of in situ methods is required. Radiotracer methods, first of all the so-called radiotracer thin foil method, provide unique possibility of in situ monitoring of chromate adsorption on a powdered adsorbent.

As to the role of the labelled species in the radiotracer study of adsorption phenomena, two different versions of the thin foil method may be distinguished. The first one is the direct method, in which the species to be studied is labelled and the radiation measured gives direct information on the adsorption of this species. The second method is the so-called indirect method. In this case instead of labelling the species to be studied another labelled, indicator species is added to the system and the adsorption of this species is followed. The adsorption of the species to be studied is determined on the basis of the analysis of the competitive adsorption processes. Both methods were used in the present study.

A characteristic feature connected with the very nature of the in situ methods is that the radiation measured consists of two main parts. The first one is that coming from the solution background, the second radiation component is the radiation originating from the adsorption layer. In the case of the thin foil method using isotopes emitting soft  $\beta^-$  radiation or low energy X –ray the solution background is governed and minimised by self-absorption of the radiation. In the direct study we applied an experimental methodology based on the energy selective measurement of the characteristic  $K_{\alpha,\beta}$  X – radiation emitted by the  $^{51}\text{Cr}$  –labelled chromate species while for the indirect study  $^{35}\text{S}$  –labelled sulphate ions were used as indicator species.

The specific adsorption of chromate ions, determined in the presence of a great excess of perchlorate ions, was found to be completely reversible on the aluminium oxide. The pH-dependence of surface excess shows that the adsorption is governed by the protonation state of the oxide, i.e. a significant adsorption occurs only below  $\text{pH} = 6$ , and the concentration dependence of the adsorption can be described by a Langmuir isotherm. It is an important observation that the absorbability of chromate ions on  $\gamma\text{-Al}_2\text{O}_3$  is significantly lower that of sulphate ions. It is demonstrated that direct and indirect methods furnish reliable information on the main tendencies characterising the adsorption of chromate species on aluminium oxide.