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IT-14-P-3424 Surface Potential Distribution on Quartz Crystal Surfaces by AFM Silica-Probing

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Interaction forces between colloidal particles play an important role in numerous physicochemical systems in mineral, ceramic, and environmental sciences since they determine stability, rheology, and forming characteristics. Control and manipulation of these properties depend on detailed analysis of the interactions among the particles. Interparticle interactions can be divided into two main categories; van der Waals(vdW) and Electrical Double Layer [1,2].
Proper use of these theories and their comparison with the experimentally measured force values require knowledge of such material properties as Hamaker constants and charge on the interacting surfaces. The surface potential at the point of measurement could then be determined from the electrostatic component. Multiple AFM force measurements on carefully selected locations on the surface could be used to generate a surface charge/potential map of the surface using appropriate theories [3,4,5].
In this study we used a powerful surface analysis tool, AFM, to determine the surface charge or surface potential on quartz single crystal surfaces in aqueous solutions. This use of AFM is new and novel and requires insightful use of theory and experiment. Using AFM to map the charge distribution on surfaces in solution is different than the EFM measurements in air since measuring surface potential in air or in vacuum is a straightforward process which has been used for years using different devices. The methodology, we used is basically depends on a point by point comparison of measured interaction force between a surface and the AFM tip of known characteristics with the theoretical force predicted for the same system. The results were confirmed with separate electrokinetic measurements of all surfaces.

References

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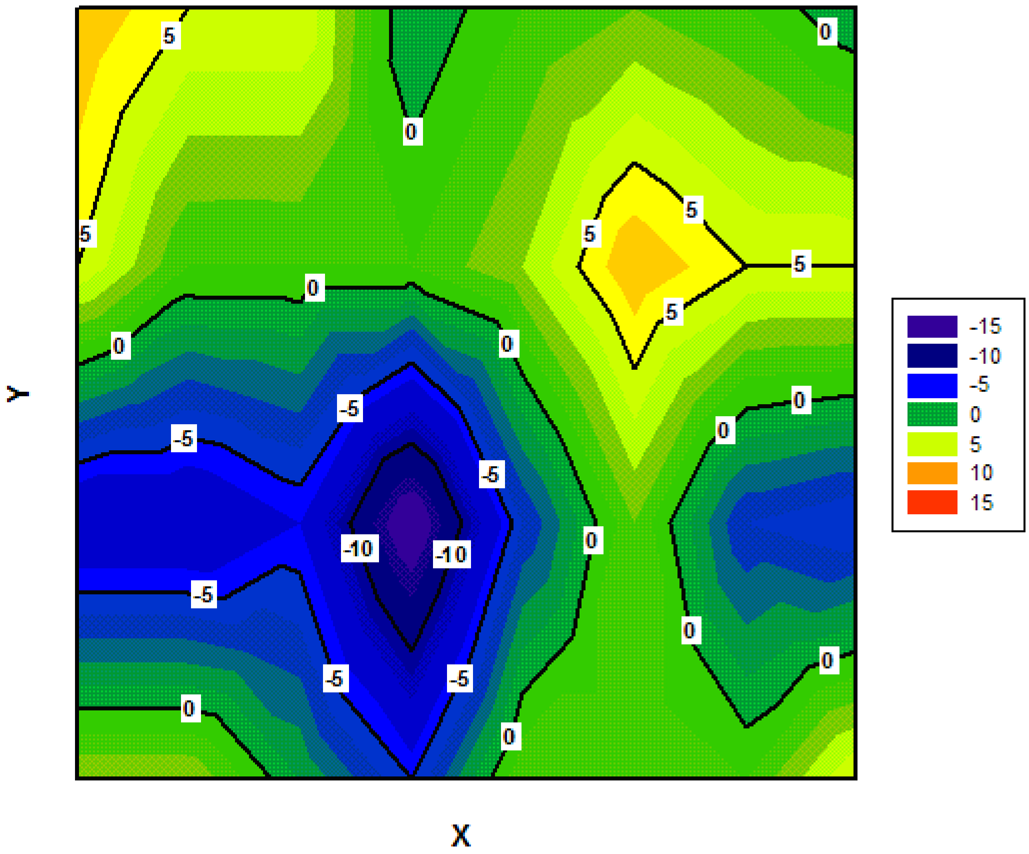

Fig. 1: Surface potential distributions on a 5 µm × 5 µm portion of the quartz (0001) surface at pH=2 values in 10−3 M KCl solution.