

2.1.P09

Mechanism of palygorskite-Cu(α) interaction in aqueous suspension

TIANHU CHEN¹, SHUCHUAN PENG¹, CHENGSONG QING¹,
CHUANHUI HUANG¹, HUIFANG XU² AND XIAOLI SHI¹

¹ Natural Resources and Environ. Engineering, Hefei Univ. of Technol., 230009, P.R. China (cth168@hotmail.com)

² TEM Lab, Department of Earth and Planetary Sciences, The University of New Mexico, NM 87131, USA

Defining adsorption mechanisms and heavy metal uptake capacity improves understanding of adsorption processes, heavy metal behaviour and applications for environmental minerals. Copper adsorption on palygorskite was examined. Solution pH and surface microstructure were examined before and after adsorption. Results indicate that copper removal efficiency is related to stirring rate, exposure time, initial pH and the amount of adsorbent. The copper adsorption isotherm fits the Langmuir Equation or the BET Equation. However, the removal mechanism was mainly attributed to induced hydrolysis of copper ions by palygorskite and interaction between copper hydroxide (a positively-charged colloid) and palygorskite (a negatively-charged colloid). This mechanism is different than the mineral-water interface adsorption by strict definition. The reason of induced hydrolysis is that palygorskite belongs to natural nano-materials and thus has nano-effect and surface chemical activity. Surface hydrolysis of palygorskite increases alkalinity of palygorskite-water suspensions, so pH was increased to reach the value of copper hydrolysis.

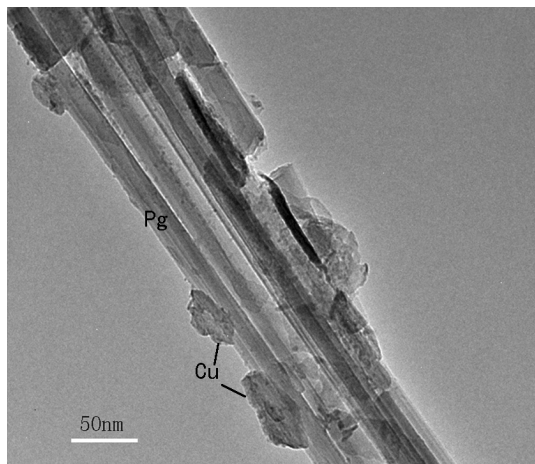


Fig. 1 TEM bright field of palygorskite after exposure to 50 ppm Cu^{2+} (pH=5). Cu-hydroxide colloidal particles attached.

References

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2.1.P10

Dolomite surface kinetics and composition from supersaturated and undersaturated non-stoichiometric solutions

X. HU AND S. R. HIGGINS

Chemistry Department, Wright State University, Dayton, OH 45435, USA (steven.higgins@wright.edu)

Studies of dolomite cleavage surfaces exposed to flowing undersaturated and supersaturated solutions were performed using in-situ scanning force microscopy (SFM). at room temperature at pH = 9. In these studies, growth was found to be limited to a single ionic layer overgrown on the original dolomite crystal surface. Growth of additional layers was observed, but the step growth rates were nearly two orders of magnitude smaller on additional layers. This type of behavior was also observed by Astilleros et al.[1] in studies of heteroepitaxy on calcite surfaces from Mn-bearing supersaturated solutions.

From supersaturated solutions rich in calcium ions ($[\text{Ca}^{2+}]/[\text{Mg}^{2+}] > 10$), a distinct difference in tip/surface lateral force was observed on top of the overgrowth compared to the original substrate surface. In solutions with $[\text{Ca}^{2+}]/[\text{Mg}^{2+}] < 0.1$, no contrast in the lateral force data was observed. The higher frictional force observed in calcium rich solutions likely results from differences in surface strain and/or interfacial water structure over the presumed compositionally contrasting surface regions. Recent studies of lateral forces on heteroepitaxial layers on calcite [2] further suggest that SFM may differentiate regions of differing surface composition.

Dissolution of the overgrown layers occurred from less concentrated solutions, but these solutions were still significantly supersaturated in dolomite. These initial investigations suggest that SFM may provide semi-quantitative surface compositional information with additional understanding of the tip/surface interactions.

References

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