

RESEARCH FIELD:

Materials Science and Cultural Heritage

RESEARCH TOPIC:

Synthesis and characterization of nano-composites to be used as hybrid pigments

PARTICIPANTS AND COLLABORATIONS:

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RESEARCH DESCRIPTION:

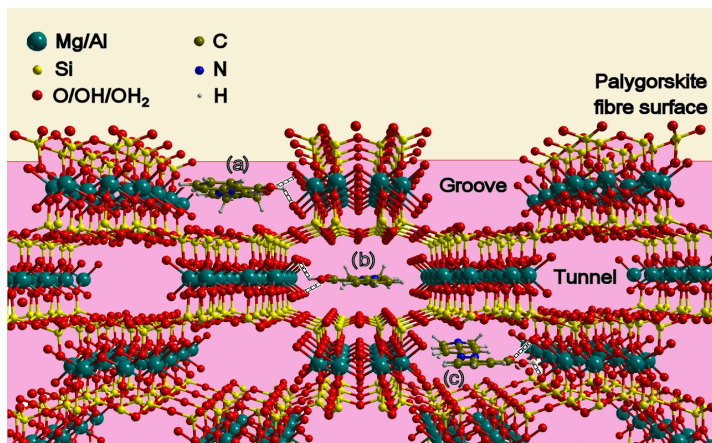
The sorption properties of palygorskite were exploited to produce new nanostructured materials, based on the fixation of different dyes in the host matrix and aimed to create a *palette* of Mayan-inspired and environmental-friendly pigments, granted by limited toxicity (absence of heavy-metals) and low production expenses. Efforts were primarily concentrated on the synthesis of stable red composites, due to the high potential request on the market. Stable palygorskite-based nanocomposites were formed with methyl red and alizarin, whereas Sudan red and murexide adducts lacked the required efficiency. Host/guest interactions were investigated by coupling diffraction and spectroscopy techniques. The palygorskite + methyl red (2 wt%) adduct evidenced chemical, thermal and photo-stability comparable to Maya Blue, as fixation on the hosting matrix stabilizes the dye preventing both deterioration and color changes in spite of severe pH fluctuations. Such a hybrid composite can be applied as a 'Maya Red' pigment both in the Cultural Heritage and Materials Science fields. Alizarin solvation (2 wt%) on palygorskite, alternatively, evidenced pH induced color changes analogous to those shown by the same in solution, implying possible use as a solid pH sensor. In both cases, different supramolecular host/guest interactions form during synthesis: while methyl red diffuses inside the palygorskite tunnels, forming specific bonds and providing stabilization and shielding from external environment, alizarin is due to form surface complexes with the clay superficial silanols, allowing molecule response to pH and related color changes.

LABORATORIES OF THE DST IN USE:

X-Ray Powder Diffraction Laboratory; SEM-EDS Laboratory.

RESEARCH PRODUCTS:

- G. Chiari, R. Giustetto, J. Druzik, E. Doehne, G. Ricchiardi, Appl. Phys. A 90(1) (2008) 3-7.
- R. Giustetto, K. Seenivasan, S. Bordiga, *Period. Min.* (2010), 79, 21-37
- R. Giustetto, K. Seenivasan, F. Bonino, G. Ricchiardi, S. Bordiga, A. Damin, M.R. Chierotti, R. Gobetto, J. Phys. Chem. C 115(41) (2011) 16764-16776.
- R. Giustetto, O. Wahyudi, Microporous and Mesoporous Materials 142 (2011) 221-235.
- R. Giustetto, O. Wahyudi, I. Corazzari, F. Turci, Appl. Clay Science 52 (2011) 41-50.
- R. Giustetto, D. Levy, O. Wahyudi, G. Ricchiardi, J.G. Vitillo, Eur. J. Mineral. 23 (2011) 449-466.
- R. Giustetto, R. Compagnoni, Clay Minerals 46 (2011) 371-385.
- R. Giustetto, K. Seenivasan, D. Pellerej, G. Ricchiardi, S. Bordiga, Microporous and Mesoporous Materials 155 (2012) 167-176.



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