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Diffusion of water in waterborne polymer colloid films containing different hydrophilic shells

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The waterborne latex films, obtained from the dispersions of latex particles are of particular interest due to the non-content of volatile organic compounds (VOC), which is often mandatory under environmental legislation [1]. However, abrupt water penetration inside the films restricting their lifespan and deteriorating the shining of the coating, limiting their uses [2]. In order to prepare efficient and solvent-free coatings with the low glass-transition temperature (Tg < the drying temperature) but with higher mechanical strength, we have integrated hydrophilic layers (Acrylic acid/ Poly(acrylamide)) around the hydrophobic cores (mixture of Methyl methacrylate and Mutyl acrylate) in the latex film. Polymer latex particles with different morphologies (hairy layer variants and core-shell particles) have been synthesized using emulsion polymerization. Polymer latex films have been prepared in the next step by evaporating water in a thermo- and humidistatic chamber at temperature 25 oC. The structure formation of polymer latex films in the dry state (crystallinity) and in re-swelled state (change in crystallinity and whitening or blushing) have been studied to propose a recipe for the preparation of efficient latex coatings. The combine study by small-angle neutron scattering (SANS) and small-angle X-ray scattering (SAXS) show the FCC-like structure formation by the latex film, which become more organized with the inclusion of the that the hydrophilic shell. The inclusion of hydrophilic shell also promotes the formation of the homogeneously swollen film and slows down the development of water "pockets", preventing the deterioration of the latex film over time.

1. T.N. Tran, E. Rawstron, E. Bourgeat-Lami, D. Montarnal, ACS Macro Lett. 7 (2018) 376.
2. I. Konko, S. Guriyanova, V. Boyko, L. Sun, D. Liu, B. Reck, Y. Men, Langmuir. 35 (2019) 6075.

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