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Nanoconfined reactions in clay nanotubes based on metal salt loading

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Halloysite nanotubes are formed by 10-15 revolution of kaolin aluminosilicate sheets and have diameter of 50 nm, a lumen of 15 nm and length 500-1000 nm. It is environmental freindly, natural and cheap tubule nanomaterial available in thousand tons. Halloysite surface is SiO_2 and the tube inside is Al_2O_3 which are oppositely charged at pH range 3-9. Due to this, halloysite may be considered as efficient divalent nanoadsorbent both for cations and anions. It is possible to load metal ions selectively into 15 nm diameter halloysite lumens and synthesise nanorods or peapod-like packing of metal nanoparticles, as demostrated for silver, gold and magnetite; heavy metal ions, however, do not penetrate into 0.7-1.0 nm interlayer space of the roll. Halloysite tubes have surface area of 60 m^2/g, but enabling access to the interlayer space increases its adsorption capacity to 500-900 m^2/g. Some polar organic compounds such as ethyleneglycole, acetonitryle, dimethylsulfoxide intercalate the tube wall interlayer. Furfural has shown especially good intercalation abilities providing further formation of organic ligands of different types. In particular, Schiff bases are provided for Pt, Pd, Rh, Ru, Ni, Cu, and Au ion nucleation from aqueous or alcoholic solutions at elevated temperatures. This allowed for simple exclusion of metal ions from solutions. Reducing the sample resulted in formation of metal nanoparticles in the nanotube interior and freeing the ligands which allows for repetition of the process. Heavy metal nanoparticles of 1-5 nm were formed both in the lumen and in the interlayer space of the tube walls.

Biography

Anna Stavitskaya received her PhD in 2015 from Gubkin State University of Oil & Gas and has 12 publications in petrochemistry.

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