

## Modification of nano-sized tin oxide-hydroxide as photocatalyst

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Tin (IV) oxide and hydroxide of different origin are the basis of ion-exchangers, sensors, photocatalysts. Therefore, preparation of them in nano-state is very important. We modified tin oxo-hydroxide samples of the composition  $\text{SnO}(\text{OH})_2$  in the form of powder P (commercial sample) and precipitated xerogel X (laboratory sample) via mechanochemical and microwave treatments (MChT and MWT, respectively). The former is low crystalline with crystallite size  $D=4.2$  nm and specific surface area  $S=198 \text{ m}^2/\text{g}$ . The latter has X-ray amorphous structure and  $S=108 \text{ m}^2/\text{g}$  (particle size about 8 nm). Dry milling and MWT of both samples leads to partial removal of OH-groups but milling in water does not change of chemical composition. At the same time, crystal structure remains almost unchanged after MChT and improved as a result of MWT.

Both samples are micro-mesoporous. Their porous structure is little changed under milling. At the same time, MWT causes transformation of micro- into mesopores and increase total pore volume. It is noteworthy that MChT of sample P leads to decrease of specific surface area  $S$  while this value, on the contrary, increases after MChT and MWT of sample X.

UV-Vis spectra show that the changes of absorption in visible region ( $> 400$  nm) do not occur as a result of MChT and MWT of both samples. The hypsochromic shift (the same regardless of the intensity of the treatment) of absorption edge is observed for all milled samples. The latter indicates broadening of the band gap  $E_g$  from 3.70 to 4.01 eV and from 4.09 to 4.17-4.25 eV for samples P and X, respectively. In contrast, MWT results in bathochromic effect and corresponding narrowing of band gap for modified samples X: from 4.09 to 3.8-3.9 eV.

All modified samples higher exhibit photocatalytic activity in processes of dyes (rhodamine B, safranin T) degradation in aqueous medium compared with initial samples. Thus, rate constant of dye degradation  $K_d$  achieves  $3.6\text{-}8.8 \cdot 10^{-5} \text{ s}^{-1}$  for milled P samples under visible irradiation. The samples X are less active in the same conditions: value of  $K_d$  is equalled  $2\text{-}3 \cdot 10^{-5} \text{ s}^{-1}$ . However, their activity sharply improves under UV illumination: rate constant of dye degradation increases 3-5 times. Under mechanocatalytic degradation,  $K_d$  is maximal and achieves  $3 \cdot 10^{-4} \text{ s}^{-1}$ .