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# THE ROLE OF ZINC OXIDE NANOPARTICLES AS A MODIFIER OF SODIUM WATER GLASS

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**Keywords**: nanoparticles of zinc oxide (ZnO); modification; sodium water glass; physicochemical properties (wettability, viscosity)

**Abstract:**

The paper presents research of the influence of morphology and size of ZnO nanoparticles on the structure and physicochemical properties of water glass. In the conducted research, water glass was modified adding of the 5% mas. colloid of ZnO in methanol and propanol solvents and homogenising the mixture. Modifiers (ZnO colloid) as used had a constant molar concentration of $c_{(ZnO)}$ = 0.3 M.

Synthesis of zinc oxide nanoparticles was carried out by an anodic dissolution of metallic zinc in alcohol solutions of lithium chloride containing 5% vol. of water [1]. The parameters of anodic dissolution based on Zn polarization curves.

ZnO colloid addition to water glass (5% mas.) slightly increases its viscosity and significantly improves the wettability of quartz grains. In addition the modifier led to increased cohesive strength $\sigma_K$ modified water glass.

## 1. Research part

### *1.1. Morphology and structure of ZnO nanoparticles*

The study showed that zinc oxide (ZnO) nanoparticles have a crystalline structure. The size and structure of this nanoparticles depends on the type of alcohol. Nanoparticles obtained in methanol (fig.1) are ~ 50 nm and 20 nm in propanol (fig.2).

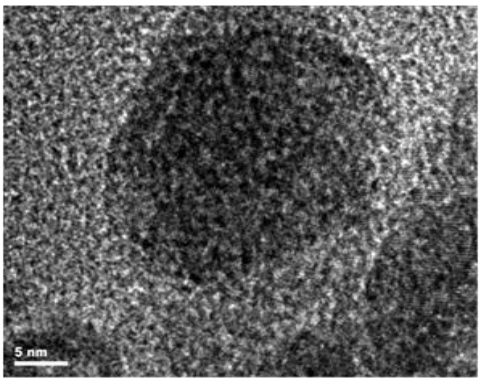



**Fig.1.** HRTEM nanograph of the powder obtained in methanol electrolyte [2].

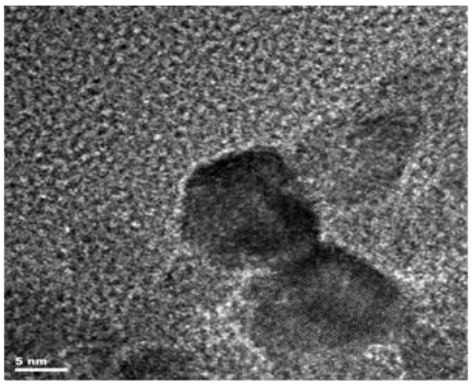
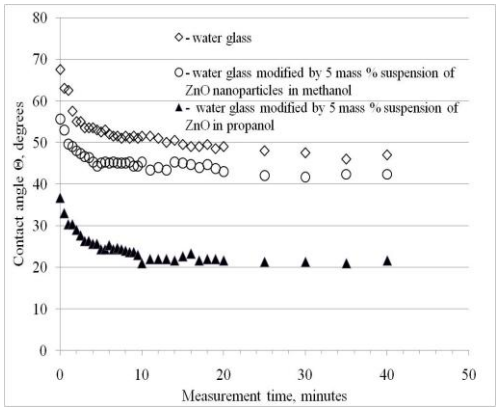


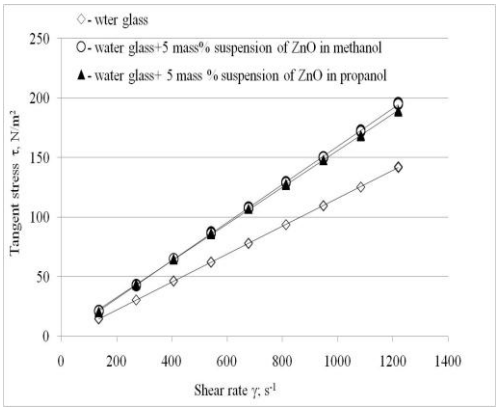

**Fig.2.** HRTEM nanograph of the powder obtained in propanol electrolyte [2].

*1.2 The effect water glass modification*

ZnO colloid addition to water glass (5% mas.) slightly increases its viscosity and significantly improves the wettability of quartz grains.




**Rys. 3.** Time-related changes in the value of contact angle in a quartz-modified water glass system [3].




**Rys.4.** Flow curves plotted for water glass modified [3].

The addition of modifier in the form of a colloidal solution of ZnO nanoparticles in propanol led to increased cohesive strength $\sigma_K$ modified water glass (fig.5). Molding sands with modified binder characterized by higher strength $R_m^u$ (at ambient conditions) by about 28% compared with the $R_m^u$ of the sand bonded with an unmodified water glass (fig.6).

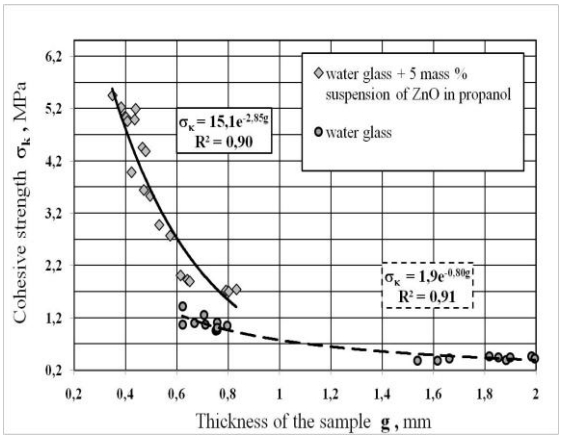



**Fig.5.** The cohesive strength $\sigma_K$ sample thickness dependence for water glass unmodified and modified [3].

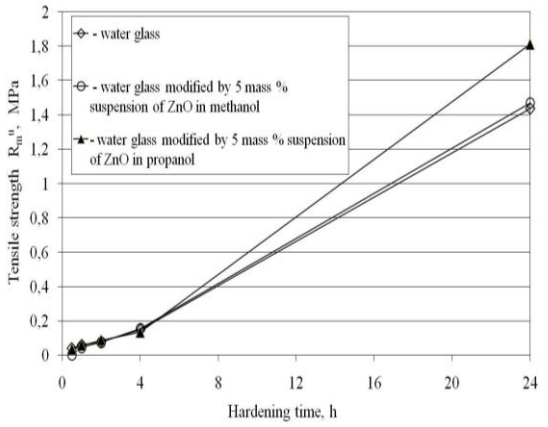



**Fig.6.** Effect of hardening time on the tensile strength $R_m^u$ of loose self-setting sands with water glass [3].

## References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