INFLUENCE OF RATIO OF SILICON COMPLEX AND HYDROLYSER AGENT ON SILICON DIOXIDE CHARACTERISTICS

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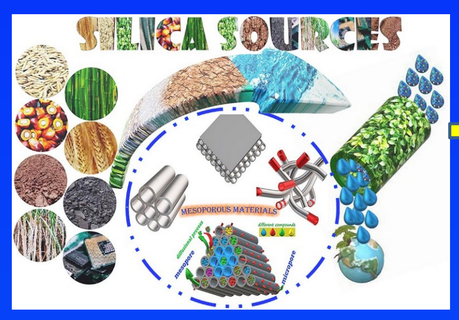
Introduction

It is known that the physicochemical characteristics of amorphous SiO_2 are influenced by the raw material, process temperature, pH of the reaction medium, the ratio of reagents and many other indicators. Previously, a waste-free technology for the production of biogenic silicon dioxide was described. However, there was a question of the ability to control the size of the final product. Therefore, the aim of our work was to study the effect of the ratio of mass concentrations of silicon-containing solution and hydrolyzing agent (5:100 (Si100); 5:500 (Si500); 5:1000 (Si1000)) on the physicochemical properties of the final product.

Experimental



Fluoridation

Refining

5:100

5:500

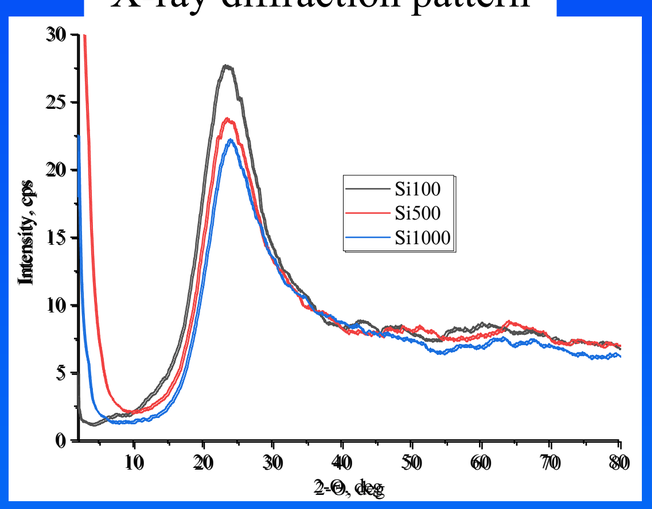
5:1000

Filtering

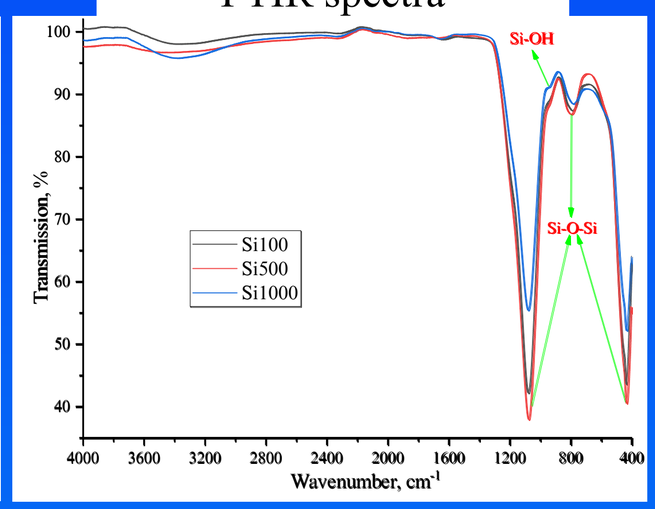
Sedimentation

Results and discussion

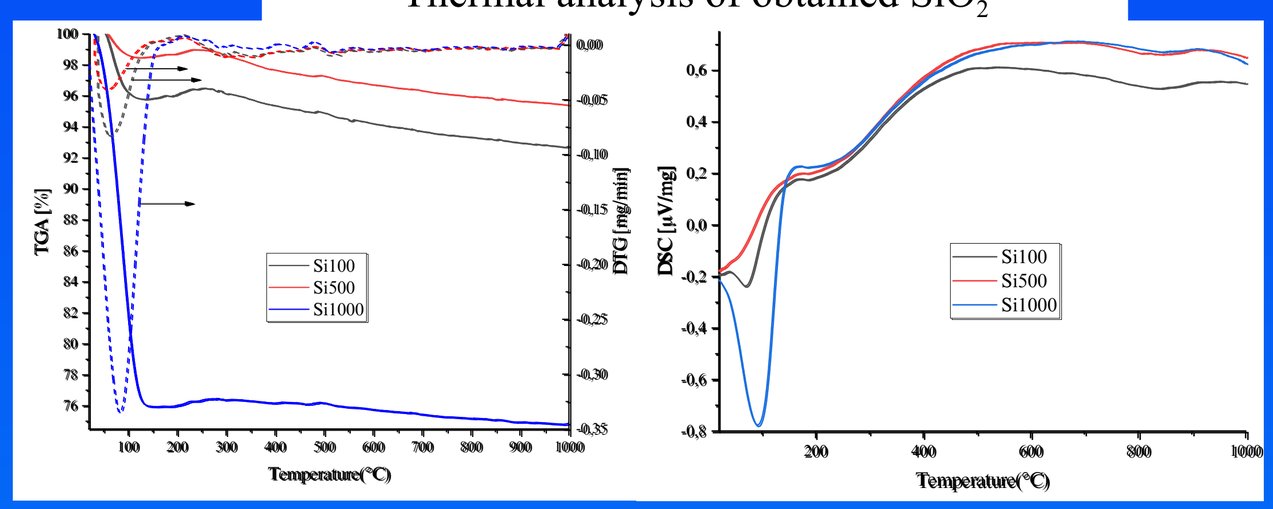
X-ray diffraction pattern



FTIR spectra

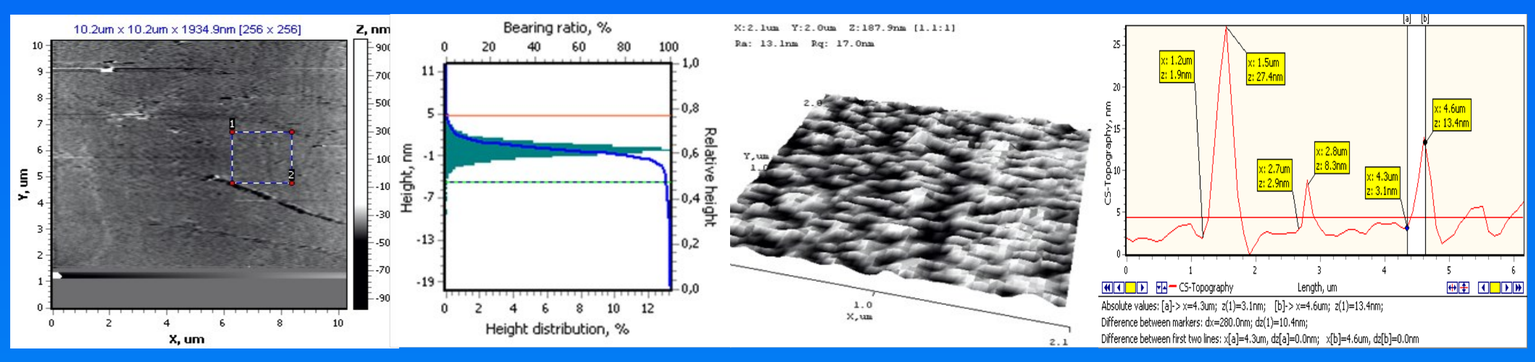


Thermal analysis of obtained SiO_2

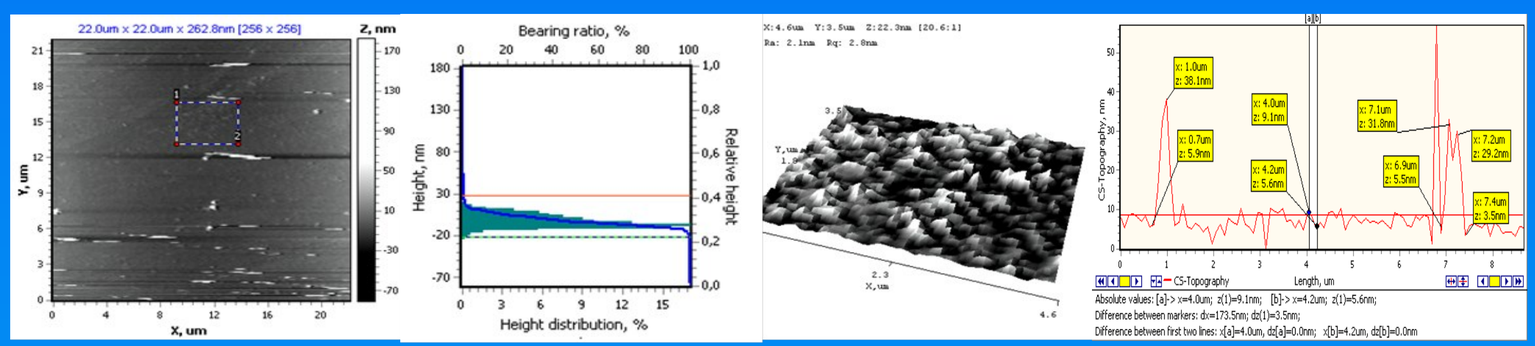


AFM micrographs of obtained SiO_2 depending on condition

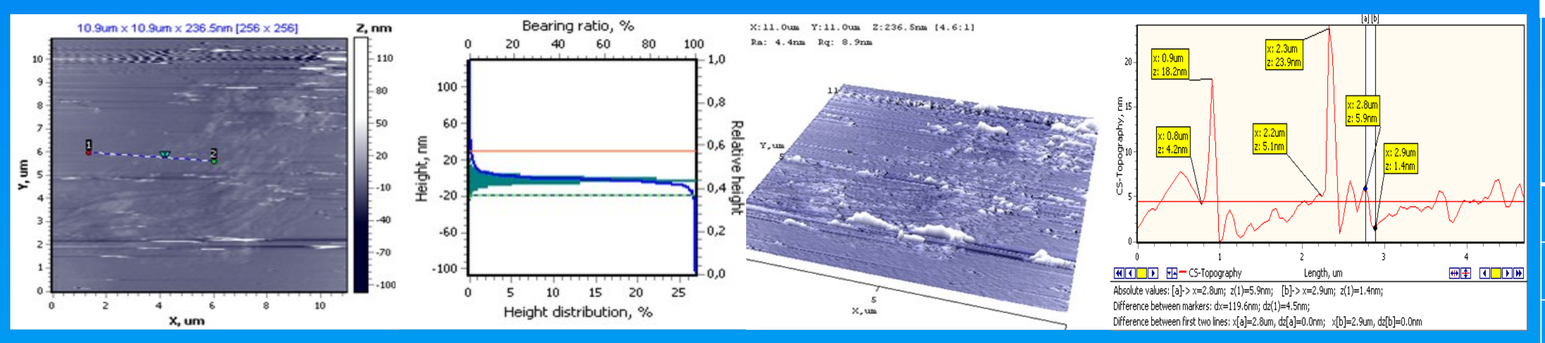
Si100



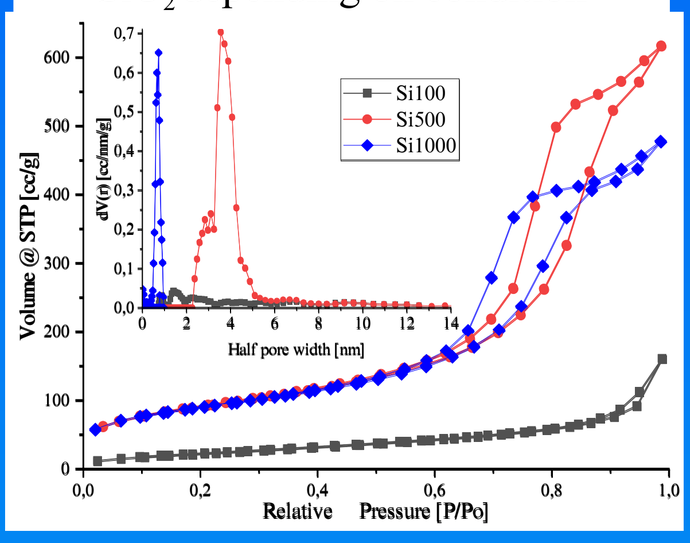
Si500



Si1000



Nitrogen adsorption–desorption isotherm, and DFT-calculated pore size distributions (insert) curves for SiO_2 depending on condition



Textural properties of SiO_2 depending on condition

Concentration	Surface Area (m^2/g)	Pore Volume (cm^3/g)	d_{BJH} (nm)
100	86.75	0.23	3.30
500	318.3	0.94	13.82
1000	310.2	0.72	9.16

Conclusion

XRD pattern of the obtained silica showed that the 2-theta region between 5° to 45° at long collection times indicates no crystalline peaks. The FT-IR spectrum of the whole silica samples show typical functional groups correspond to pure silicon dioxide at 1074, 982, 800 and 457 cm−1. There are two distinct mass loss steps in termograms (TGA). The first step (less than 130 °C) is abrupt (1.5-24 % depending on samples) and is most probably due to the removal of physisorbed water from the silica surface. The second step (1.2-3 % depending on samples) is border and is considered to correspond to slow condensation of silanols. It was established that obtained samples had a specific surface area 86.8, 318.3 and 310.2 m2/g and pore size 3.3, 13.8 and 9.2 nm depending on concentration (100, 500 and 1000). The AFM method established that the obtained silica has a relief consisting of spherical particles (80.3 nm) and densely packed rod formations (1.5x160.6 nm). After reducing the SiO2 concentration by 5 times, the presence of individual particles and folded aggregates (ridges) is characteristic. Characteristically, the 3D image clearly shows the pointed vertices of SiO2 tetrahedral after a 10-fold decrease in SiO2 concentration.