

Extended Abstract

# The Antibacterial Action of Various Silver Nanoparticles Used for the Stone Treatment<sup>†</sup>

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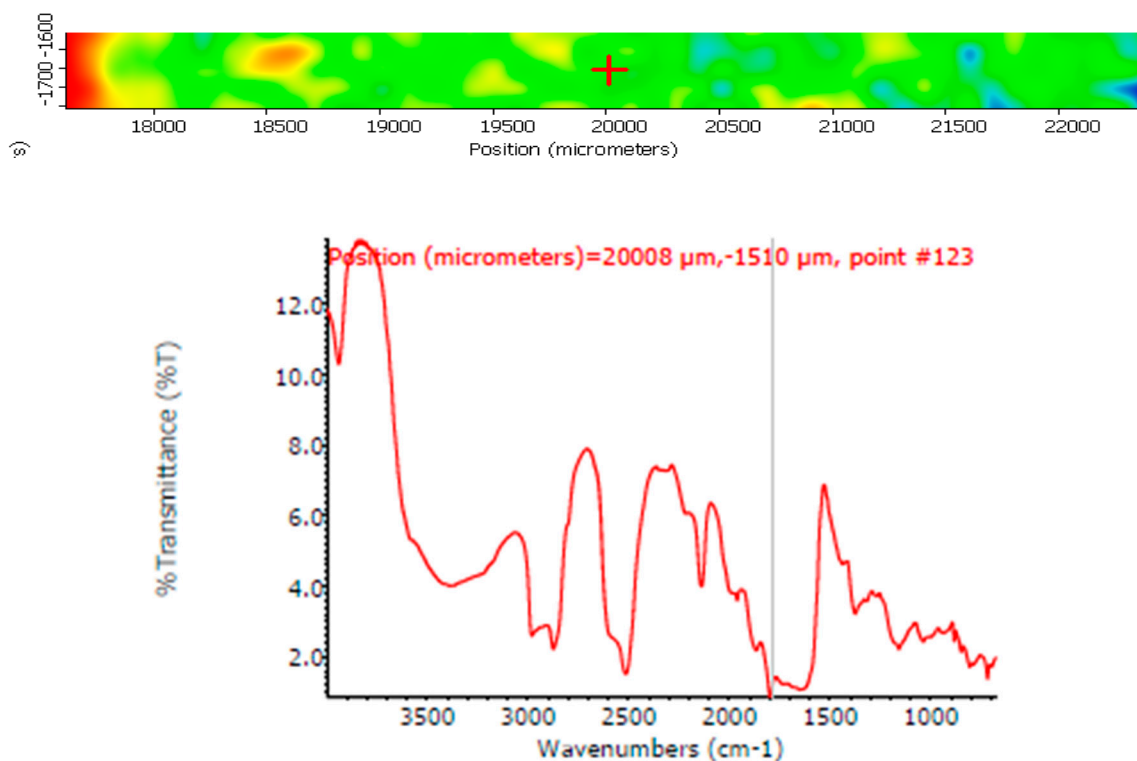
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The antibacterial effect of silver nanoparticles is known from the ancient world. Based on their high antimicrobial effect, silver nanoparticles can be used in stone treatment together with siloxanes components as the coupling agent. The application of certain silver nanoparticles on the stone treatment could be used as the protection of stone monuments, claddings, and heritages. The antibacterial effect of silver nanoparticles consists of the protection of various surfaces against the formation of biofilms.

The present work aims to follow the impregnation of various types of stone, usually used in the construction as décor elements, travertine, limestone, marble, with different products as siloxanes and silver nanoparticles solutions to protect their surface against aggressive climatic factors and microorganisms. The silver nanoparticles obtained by different methods were chosen, based on their antibacterial effect, to treated various substrate. It is known the antibacterial effect of the silver nanoparticle acting against on the various microorganism strains. The application of silver nanoparticles as the protective film or the impregnation of stone substrates shown an efficiency against the microorganism formation acting not only on the surface of the treated substrate also inside of their structure [1–3].

The silver nanoparticles were obtained by chemical methods at room temperature or solvothermal method using silver nitrate and various reducing and stabilizer agents as sodium borohydride, sodium citrate, polyethylene glycol, polyvinylpyrrolidone. The selected stones' surfaces were treated with siloxanes, as the coupling agent with thiol groups containing various silver nanoparticles synthesized by various routes [4–6]. The impregnated stones were tested by FTIR, SEM EDAX, and microbiological tests. All tests were done confirmed the presence of silver nanoparticles both on the stone treated surface also inside of the stone structure. The biological test confirmed the presence and activity of silver nanoparticles against the microorganisms. Figure 1 IR spectra indicated the impregnation of the limestone confirmed by the SEM EDAX test.



**Figure 1.** Limestone impregnated with the mixing of the COAT O SIL product and alcohol.

The treatment of the stone surface with silver nanoparticles using various types of siloxanes could lead to the high antimicrobial efficiency of the surface with a protective role against the formation of biofilms.

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