The research project will be focused on the surface treatment, with nanomaterials, of luxury marble tables generally produced by the enterprise S2 SpA (Fermignano, PU) for indoor and outdoor luxury furniture.

The deterioration of stones (mainly limestones and marbles) altering both their aesthetical aspect and their physical‑chemical properties should be considered both in indoor and outdoor conditions. In this way, the enterprise is interested in finding appropriate treatments to avoid this kind of deterioration, mainly when the stone tables are already sent to the customers.

Aesthetic variations of stones may be related to damaging processes such as for example growth of organisms, salt efflorescence, external factors as humidity and irradiation or the intrinsic characteristics of stones themselves.

One of the most widespread material used as stone surface treatment to avoid deterioration (mostly by self-cleaning) is titanium dioxide (TiO_2) which is the most occurring oxide of titanium. It is present in three main different mineral forms: rutile, brookite, and anatase; rutile and anatase show a tetragonal crystalline structure while brookite is orthorhombic. One of the main characteristic of nanometric TiO_2 is its ability to activate further features by means of the exposure to light: the so called photoinduced properties. Titanium dioxide is typically a n-type semiconductor and its photoinduced abilities are mainly related to the generation of charge carriers (free electrons and holes) by interaction with photons having sufficient energy. In the case of TiO_2 ultraviolet (UV) light, including the UV range of sunlight, is necessary to its own activation.

In order to evaluate both efficiency and compatibility of TiO_2 treatments to avoid deterioration of the surfaces of the stone tables, it will be necessary to test the fulfilment of several essential requirements such as: a) avoiding the change of original aspect of stone; b) compatibility of the titanium dioxide coatings with other conservative treatments; c) achieving self-cleaning and biocidal efficiency; d) stability of the nanocoatings over time. All these requirements will be proved by laboratory tests.

The research project will be also addressed to increase the efficiency of the titanium dioxide evaluating several parameters, as for example: the size of nanoparticles, the titania loading in the sols, the use of doping materials to enhance the photoactivity, the reactivity of titanium dioxide to visible light, and other features.

Finally, besides titanium dioxide, other nanomaterials will be also tested as treatments to avoid deteriorations and as biocidal efficiency on the surface stone tables produced by S2 SpA.