Laboratory of Laser Applications

Laboratory of Laser Applications
Institute of Optoelectronics,
Military University of Technology,
Warsaw

The ***research interest of Laboratory*** focuses mainly on two fields of research: application of lasers & optoelectronics in conservation of monuments and works of art; laser ablation as a source of specialized nanoparticles and nanostructures.

The use of laser cleaning, in contrast to chemical and mechanical treatments, acts without physical contact, enabling a gradual and selective cleaning confined to the parts affected by black crusts. Furthermore, careful and experienced operators can also ensure conservation of the patina since the laser technique offers a greater degree of control over the cleaning process compared with chemical and mechanical methods and is less aggressive than mechanical techniques.

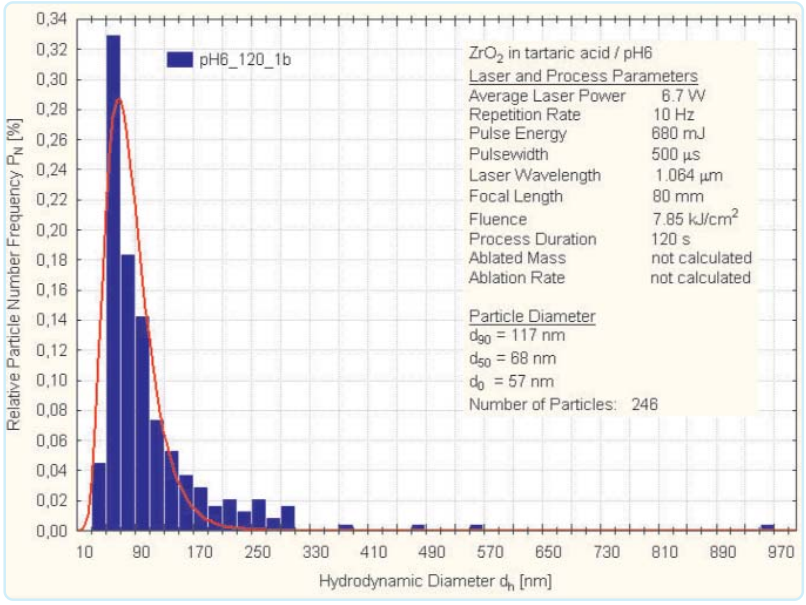
The greatest team experience, acquired during more than ten years of laser cleaning experiments, has been gained in the cleaning of stones and followed by many of case studies, also in the frames of largest **Polish project – laser renovation of Sigismund Chapel** (Fig.1), **Wawel Castle, Krakow** *(over 800 m2 of decorative stone walls and sculptures)*. However, other works on such materials as wood, bone, ivory, parchment (Fig.2), paper, gypsum, metals and fabrics were also performed.

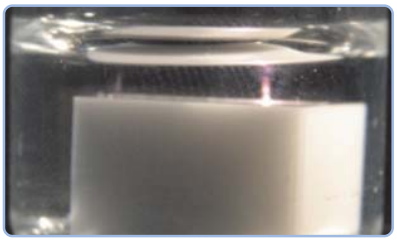
Since 2006, the group at IOE MUT, together with team of experienced scientists from Hannover Laser Zentrum (LZH), Germany has been investigating the nanoparticle generation using laser ablation in liquids and gases. With short-pulse (fs, ps, ns) laser material ablation, both laboratories are able to produce nano-scaled particles from practically any solid material, even maintaining stoichiometric compositions. Method can be especially interesting for nanoparticles that are not available at the market. The production of nanocomposites can be realized in a single processing step. Unique feature of the method is the direct dispersion/stabilization of the nano-particles into liquids, since they are generated in liquids quenching the nanoparticle growth and acting as surfactant. *Figure 3 shows results of measu-rements of nanoparticles dimensions distribution, obtained for zirconia ablation in tartaric acid using Nd:YAG laser (LZH laboratory). Photographs below show process and apparatus.*

Fig.1. Eagle at the head-stone of king Sigismund the Old. White frame – tests of laser cleaning of alabaster and Hungarian marble.

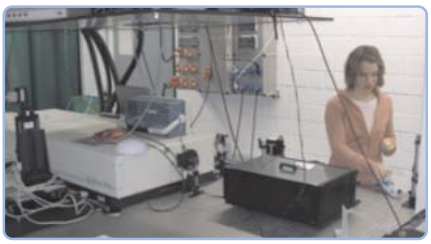
Fig.2. Nd:YAG laser cleaning of 15th century old parchment.

Fig.3. Measurement system – NanoSight LM10.

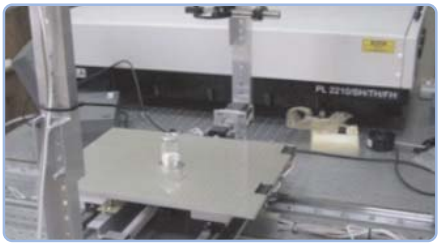




Laser ablation (fs pulses) of zirconia in distilled water (LZH).



Femtosecond laser stand in LZH.



Picosecond laser stand in IOE MUT.

Contact: **Dr Marek Strzelec (mstrzelec@wat.edu.pl). Phone: +4822 6837813,**
Institute of Optoelectronics, Military University of Technology, Address: 2 Gen. S. Kaliskiego Str., 00-908 Warsaw, Poland.

The publication of this page is supported by the ***MINOS-EURONET*** project (EC Contract No 015704)