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Characterisation of Highly UV Absorbing Coatings at MIRACLS

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Collinear Laser Spectroscopy (CLS) plays an important role in the study of short-lived radionuclides as it reveals nuclear ground state properties such as spin, electro-magnetic moments and mean-square nuclear charge radii[1, 2]. To access exotic radionuclides with very low production yields, the Multi Ion-Reflection Apparatus for Collinear Laser Spectroscopy (MIRACLS) is currently being developed at ISOLDE [3–5].This novel approach significantly improves the experimental sensitivity of CLS by confining an ion bunch of rare isotopes in a Multi-Reflection Time-of-Flight (MR-ToF) device. While the ions are bouncing back and forth between the electrostatic mirrors of the MR-ToF apparatus, the same ion bunch can be probed by the spectroscopy laser during each revolution. This increased observation time boosts the sensitivity by a factor of 30-600 compared to conventional CLS.

A leading contribution to background in fluorescence-based CLS is found in laser-induced stray light which is scattered into the photon detectors in the optical detection region. For this reason, the inner components of a conventional CLS beamline are typically painted in light-absorbing colours to minimise this source of background. These coatings must exhibit good electric conductivity to establish well-defined electric fields and, hence, well-controlled ion trajectories and energies. At MIRACLS, the requirement of excellent vacuum conditions in the MR-ToF device poses additional constraints on the outgassing rates of these coatings, which are generally not well known. In order to identify materials suitable for MIRACLS, we have been characterising coatings with optimal light absorption in the UV range. In particular, their photon reflectance, vacuum performance, and electric properties are studied. Vantablack is an example for an 'ultra-black'coating based on carbon nanotubes produced by Surrey NanoSystems Ltd.[6]. At 280 nm, its total hemispheric reflectance is approximately one order of magnitude smaller than Graphite which is often used for CLS at ISOLDE. Exceeding our expectations, we have demonstrated that these new, highly UV-light absorbing coatings are also compatible with ultra-high-vacuum pressures of $<5 \cdot 10^{-11}$ mbar.

This poster will show recent results of the characterisation of highly UV absorbent coatings in comparison to conventionally used coatings. Moreover, it will be discussed in which way the best performing coatings are employed within the MIRACLS apparatus.

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References

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