Scaling Down: Unlocking the Potential of Ion Beam Analysis in the keV Range

S. Průša[1,2], E. Vaníčková[1,2], T. Šikola[1,2]

[1]CEITEC Brno University of Technology, Purkyňova 123, Brno, 612 00, Czech Republic
[2]Institute of Physical Engineering, Brno University of Technology, Technická 2, Brno, 616 69, Czech Republic

Carbon is involved in many conventional as well as progressive technologies and systems, starting from graphite, diamond, graphene, SiC, CO_2, organic molecules, etc. In addition to that, carbon atoms are present on the majority of surfaces, regardless of whether they were invited or not. The atomic surface composition is successfully studied by Low Energy Ion Scattering (LEIS) thanks to the extreme surface sensitivity of the method to the outermost atomic layer. The identification of the carbon signal by ion scattering in the low-energy range (units of keV) is not trivial. The differential scattering cross section is low even when light projectiles are used, like He^+. The carbon peak in LEIS spectra sits on the reionisation background from heavier elements presented below the surface and is located close to the sputter (SIMS) background, which rapidly increases at the lower energies. This theoretically and practically discriminates the carbon from groups of elements that are easily identified by the LEIS technique.

The quantification is even more difficult since all allotropes of carbon are effective in the neutralisation of the He^+ primary beams. This is particularly true when sp2 hybridised carbon is analysed [1].

Thus, it is not a surprise that there are not many articles and sources dealing with carbon analysis by LEIS available at the moment. Having experience with the carbon analysis in the graphene, HOPG and silicon rubber [1], we decided to extend our carbon research to other materials and surfaces containing carbon in various forms. An experimental example of He^+ 3.0 keV scattering on SiC and various organic molecules will be provided within the contribution and discussed.

Reference

[1] S. Průša, P. Procházka, P. Bábor, T. Šikola, R. Ter Veen, M. Fartmann, T. Grehl, P. Brüner, D. Roth, P. Bauer, and H. H. Brongersma, Langmuir **31**, 9628 (2015).