Optimization and quantification of the GD OES depth profiles measured with application of pulsed glow discharge.

Varvara Efimova[1], Volker Hoffmann[1], Arne Bengtson[2], Jürgen Eckert[1,3]

[1]IFW Dresden, Institut für Komplexe Materialen (IKM), Helmholtzstraße 20, 01069 Dresden, Germany
[2] KIMAB, Drottning Kristinas väg 48, 11428 Stockholm, Sweden
[3]TU Dresden, Institut für Werkstoffwissenschaft, D-01062, Dresden, Germany

Glow Discharge Optical Emission Spectrometry (GD OES) is a powerful tool for the elemental analysis of both bulk and layered samples [1]. The application of a pulsed power supply of the GD broadens the possibilities of the method [2]. It is a matter of common knowledge that with the application of pulsed glow discharges (PGD) sample heating is reduced. To estimate the extent of this temperature reduction the different approaches were applied.
However, the use of PGD at commercial GD instruments has still some limitations:

-the influence of the PGD parameters on the analytical performance is not yet enough investigated;

-there is no proper strategy and commercially available hardware for the detection of the emitted light in the pulsed regime;

-it is difficult to quantify the profiles measured with PGD, because the existing quantification model is established for the continuous discharge.

Therefore, in this work the influence of the PGD parameters on the electrical properties and light emission was investigated. The PMT and CCD light detection was compared in terms of its use with pulsed discharge.
In the presentation the results of the above mentioned studies will be presented.
On the base of the performed investigations the measurement of depth profiles of thermally fragile and thin layered samples with pulsed radio frequency (rf) GD OES was optimized. The possibilities, requirements and problems of quantification of the profiles measured with pulsed rf GD will be presented. The matrix specific as well as the matrix independent quantification approach was successfully applied to the measured depth profiles. Nevertheless, in a commercial scale it is still difficult to perform such quantification.

[1] R. Payling, D. G. Jones, and A. Bengtson, Glow Discharge Optical Emission Spectrometry. John Wiley & Sons, New York, Weinheim, Brisbane, Singapore, Toronto, 1997.

[2] Ph. Belenguer, M. Ganciu, Ph. Guillot, and T. Nelis, Pulsed glow discharges for analytical applications, Spectrochim Acta B 64 (2009) 623-641.