Free Analyte Atom Distribution, Reactions and Analyte Reatomization in Quartz Tube Hydride Atomizers for Atomic Absorption Spectrometry
Abstract of Dissertation

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The Dissertation presents summary of studies of processes taking place in quartz tube hydride atomizers for atomic absorption spectrometry.

Spatially resolved measurements of free atoms of hydride forming elements within the quartz tube atomizers (QTA) have been introduced. Both the cross-sectional [1] and the longitudinal [2,3] free atom distribution has been thoroughly investigated, bringing valuable information concerning the nature of the processes taking place within QTA. From the practical point of view, no effects arising from an inhomogeneous free atom distribution are to be expected in the most common externally heated atomizer.

The role of the tube surface in the decay of the free analyte atoms has been demonstrated. Strong evidence has been obtained on analyte reactions within the QTA, leading to the formation of polyatomic analyte particles enhancing the free atom decay. These reactions are responsible for calibration graph curvature or even roll-over. It should be noted that the existence of such particles was not directly proven here, e.g., by using non-specific absorption or light scattering. On the other hand, absolutely no indication was found for the earlier hypothesis that a lack of hydrogen radicals at higher analyte concentrations is responsible for these effects.

The processes leading to the analyte reatomization at the ends of the heated QTA have been discovered[3]. This phenomenon improves the analytical characteristics of the atomizer. Recommendations are given concerning the QTA dimensions and design, so that full advantage can be taken of the end-section reatomization and the problems arising from free analyte atom decay reactions can be minimized.

Based on the knowledge of the processes occurring in quartz tube atomizers, a novel type of hydride atomizer was proposed, named Multiple Microflame QTA[4]. This patented atomizer design employs recurrent analyte atomization and yields substantially better linearity of the calibration graphs and an order of magnitude better tolerance towards atomization interferences compared to the conventional QTA, while maintaining its excellent sensitivity, simplicity, easy operation and a low cost.

The Thesis is based on the following papers:

[1] T. Matoušek, M. Johansson, J. Dědina and W. Frech, Spatially resolved absorption measurement of antimony atom formation and dissipation in quartz tube atomizers following hydride generation. *Spectrochim. Acta Part B 54 (1999) 631-643.*

[2] T. Matoušek, J. Dědina, M. Johansson and W. Frech, Gas flow patterns and longitudinal Se free atom distribution in quartz tube hydride atomizers for atomic absorption spectrometry. *Spectrochim. Acta Part B, 55 (2000) 151-163.*

[3] T. Matoušek and J. Dědina, Fate of free selenium atoms in externally heated quartz tube atomizers for hydride generation atomic absorption spectrometry and their reatomization at tube ends studied by means of the determination of longitudinal free atom distribution. *Spectrochim. Acta Part B, 55 (2000) 545-557.*

[4] J. Dědina and T. Matoušek, Multiple microflame - a new approach to hydride atomization for atomic absorption spectrometry. *J. Anal. Atom. Spectrom., 15 (2000) 301-304.*