

## LECTURE

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## Prospects and problems in absolute analysis by electrothermal atomic absorption spectrometry

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**Abstract** The most significant achievements in the development of methods of absolute analysis in electrothermal atomic absorption spectrometry (ET AAS) made in the recent five years are discussed. Problems requiring further investigation and the significance of the concept of absolute analysis in the evolution of ET AAS are pointed out.

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**Introduction**

The possibility of absolute atomic absorption analysis free of the preliminary calibration of instrument with standard solutions was noted by Walsh 40 years ago [1]. The various aspects of this attractive idea and attempts at its implementation by flame and electrothermal atomization techniques were dealt with in a large number of papers. These studies were covered partially in reviews [2–11], the last of them having been published five years ago.

The purpose of this review is to discuss the results of research carried out in this area during the recent five years. For the sake of convenience, the following aspects of the problem will be isolated which determine the major steps in the development of absolute analysis [11]:

- (i) elimination or reduction of matrix interferences;
- (ii) linearization and stabilization of calibration curves;
- (iii) theoretical calculation of sensitivity and detection limits.

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**Reduction of matrix interferences**

The most general and most interference-free system of analysis in electrothermal atomic absorption spectro-

metry (ETAAS) is the stabilized temperature platform furnace (STPF) technology developed by Slavín et al. [12].

A new element in this system of analysis which has appeared in the recent five years is a commercial, side-heated THGA-type furnace, a culmination of extensive laboratory studies by Frech et al. [13], who had been working on it for many years. An essential advantage of this atomizer over the end-heated furnaces lies in its spatial isothermality, which has provided reduction of matrix interference, of atomization temperature and of the memory effect for many elements, as well as broadened the number of elements vaporized from the low mass integrated platform.

The end-capped THGA tube proposed by Frech and L'vov [14] has proved to be still more effective from the viewpoint of spatial isothermality. Compared with the standard design, it provides a 1.5–2 times higher sensitivity, a longer life time, and, most significantly, a substantial suppression of one of the matrix effects typical of ETAAS, that is caused by analyte trapping in the cloud of condensed matrix particles in the tube ends. Regrettably, end-capped THGA tubes have not yet come into widespread use. This does not permit evaluation of their potential in routine analysis to its full extent.

The leading position of palladium, primarily in a mixture with  $Mg(NO_3)_2$ , as a universal chemical modifier in the STPF system has substantially strengthened in recent years [15]. Despite considerable efforts (see, e.g. [16, 17]), the mechanism of its action remains a mystery. Its unraveling could permit more efficient elimination of matrix interference by properly optimizing the pretreatment conditions. The significance of palladium as a universal modifier in the STPF system appears particularly essential for the simultaneous determination of several elements with a multi-channel spectrometer.

Considerable attention has been paid in recent years to a search for materials suitable for furnace manufacture or coatings which would permit reduction of

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# Absolute Analysis

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