

IMPROVING THE DETECTION LIMIT IN EDXRF WITH PROPORTIONAL COUNTER.

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To achieve maximal sensitivity while analyzing sulfur content in oil products using simple X-ray Energy Dispersive Analyzers, it is essential to reduce an intrinsic background of the gas-filled proportional counters and to suppress scattered radiation of the filter as well as air argon fluorescence.

Design, dimensions, type of the filling gas have an effect on appearance of background signals. Ratio of the intensity in maximum of the pulse-height distribution, while detecting a monochromatic line, to the intensity of pulses at a fixed distance from the maximum is known as peak-to-valley ratio.

One part of the background is determined by the effect that the photo- and auger-electrons originated from photoionization carry a part of energy from the gas amplification area. This results in appearance of lower amplitude pulses, which may be superimposed on the valid signal.

In the work [1] this component of the background detected by the gas-filled proportional counter has been analyzed, and design and electronics for elimination of these pulses have been suggested.

A three-chambered proportional counter and an electronic coincidence system, which enables to exclude pulses due to incomplete collection of the photoionization energy, have been developed. The 10 times reduction of the background has been achieved.

But the work on modernization of the detector design seems more perspective, in particular, use of an output window, estimation of optimal dimension of the detector and its gas filling. 15 types of counters have been tested, and the initial conditions for optimization of the detector design have been confirmed. As a result peak-to valley ratio in the developed gas-filled proportional counter is equal 200.

Radiation from a sample excites the air argon fluorescence, the spectrum line of which cannot be selected by the gas-filled counter. Using of Nb-filter results in appearance of scattered background. He-filling of the area between the sample to be studied and the detector lead to complication and rise in price of the instrument. Therefore a special double filter was calculated, where the first layer was polyvinylchloride, the second layer was niobium.

The X-ray Analyzer equipped with both the proportional counter being developed and the double filter, shows 2 ppm detection limit of sulfur in oil products, what is comparable with the results achieved on more complicated wave-length spectrometers.

1. Marja-Leena Jarvinen ,Heikki Sipila, Advances in X-ray Analysis Vol.27 (1984) Wall Effect and Detection Limit of the proportional Counter Spectrometer p.539-546.