

HANDY WAVEGUIDE TXRF SPECTROMETER FOR ng SENSITIVITY

Jun KAWAI and Shinsuke Kunimura

Department of Materials Science and Engineering, Kyoto University

The author's research group has recently developed a handy type total reflection X-ray fluorescence spectrometer with using less than 2 W air cooled X-ray tube. The incident X-rays are sharpened by a waveguide, but they are white radiation without monochromatic. The key element of the present TXRF spectrometer is a compact waveguide without adjustable mechanism. Total weight of the TXRF spectrometer is less than 5 kg, most of which is the weight due to protecting the X-rays (lead containing acrylic box). Such a simple X-ray spectrometer can analyze transition metals down to a few nano grams of the absolute total mass on the quartz optical flat. This type of TXRF spectrometer is used in place of atomic absorption spectrometry (AAS) or ICP-AES, because the total amount of the solution as the sample is far less than AAS or ICP. This TXRF spectrometer is such a small size, and can also be used as an element in a complex automatic analyzer. The shortcomings of the present spectrometer are as follows.

1. The maximum energy of the X-ray tube is now limited less than 10 kV, because of electric discharge due to the too small size of the X-ray tube. Thus As, Pb, and Cd analysis is not possible.
2. The incident X-rays are white radiation, and thus the minimum detection limit is not lower than the monochromatic X-ray source TXRF. However because of the absence of the monochromatic mechanism, the spectrometer is not complicated, no adjustable mechanics, less weight, not expensive, and stronger incident X-rays.
3. The waveguide output X-rays are 0.05 mm in height and 10 mm in width. The waveguide is just like a slit and no focusing effect. Thus most of the input X-ray intensity is lost at the entrance of the waveguide. If the incident X-rays are focused in the future, and monochromatized by the waveguide at the same time, better detection limit will be expected.