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Improvement of Trace Elemental Analysis in Metals & Oxides by spectroscopy – a reformed approach

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Trace elemental profile along with major chemical composition is very critical in the metal industry. This fetches many applications starting from quality of raw materials to alloy development including all processes. Range of spectroscopic methods like AAS, ICP-OES, ICP-MS, etc. are used to determine the concentration of trace elements, however, the matrix effect is the key challenge in these techniques. Therefore, the removal of the matrix or reducing its spectral interferences in the analysis is crucial to minimize this analytical error. Different sample preparation / pre-treatment techniques such as electrolysis, standard addition method, and matrix-matched standards are employed to achieve consistent quality results in trace element analysis. In the case of electrolysis, a matrix is removed without loss of other elements, the standard addition method and matrix-matched calibration standards are used. The study of these two methods is discussed in this paper with a few case studies with different metal and metal alloys. A method has been elaborated for the determination of trace elements in copper concentrate (raw material used for copper extraction) samples by using ICP-OES. The copper concentrate sample is rich in elements like copper, Iron, & Sulphur. Hence to eliminate the high copper content, the matrix separation technique of electrolysis was used where a known quantity of copper concentrate sample was dissolved in aqua regia. The copper-free solution containing Iron, Sulphur and precious metals, are analyzed by Spectroscopy respectively. This method is validated for three different copper concentrate standards. The results obtained have been achieved more than 95% accuracy. Another such method has been established for the determination of trace elements in Aluminum alloys by using ICP-OES with standard addition technique. In this process, a known quantity of samples is digested in acids. From this solution, derived standards are prepared by the addition of a known quantity of standard elements like Mn, Pb, Cd, As, Hg, Na, Ca, Mg, K, Fe, Cr, Zn, Cu, Ni, etc. Thus, the matrix effect on the analysis of these elements would be minimized. This method is validated with reference alloys.

Biography

B Ranga Rao, Experience: 22 years of experience in R&D and Quality Control in various applications such as Food & Pharma, Metals & Mining's, Materials & Chemicals, Water & waste water, petroleum products and Pulp & Fiber etc.

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