

SIMULTANEOUS DETERMINATION OF TRACE ELEMENTS IN HIGH PURITY STEEL BY TRIPLE QUADRUPOLE ICP-MS/MS(ICP-QQQ)

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Steel manufactures require an analytical technique that is rapid, accurate, and sensitive in order to determine and reduce any possible impurities in their final product, high purity steel. Although Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is the analytical technique of choice for analyses of trace elements in steel, the sensitivity of single quad ICP-MS is not sufficiently high to allow for determination of difficult analytes such as phosphorus and sulfur. Moreover, determination of manganese in an iron matrix is extremely challenging for single quad ICP-MS due to the very high iron (^{54}Fe and ^{56}Fe) signal that overlaps the mono-isotopic signal of manganese at $m=55$. As such, successful analysis of trace analytes in steel by single quad ICP-MS requires a very time consuming and labor intensive matrix separation.

We demonstrated good analytical performance for trace element analysis in high purity steel SRMs using the highly selective MS/MS mode with the collision/reaction cell of ICP-QQQ (ICP-MS/MS). With the combination of reaction modes including O₂ mass-shift mode, we conclusively showed that all of the trace elements can be measured without any chemical matrix separation. This method can be applied as a rapid, accurate and sensitive analytical technique for determination of trace elements in high purity steel samples with only simple sample digestion.