Calculating Apportionment of Metals in $PM_{2.5}$ using Ni Isotope Characterization

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Due to its versatile physicochemical properties, Ni is a valuable commodity used in wide range of modern technologies. As demand rises, Ni processing operations are tasked with maximizing production while limiting emissions, owing to increasing evidence of epidemiological risk. Monitoring sources of particulate matter (PM) generated at Ni operations is essential for preventing dust emissions from entering the environment. Extensive speciation work has been completed for PM_{10} using methods of quantitative mineralogy, but analysis of $PM_{2.5}$ remains challenging due to the fine and ultrafine particle sizes. Nickel isotope geochemistry may be a practical tool for assessing sources of Ni in $PM_{2.5}$, as mass-dependent variations in composition have recently been shown to be distinct between geological systems, and because Ni is relatively depleted in ambient air. A double spike MC-ICP-MS method is being used to determine Ni isotope ratios in materials that are potential sources of dust at processing operations. An automated, column ion-exchange purification process (ESI Prepfast) has the ability to produce high-yield, matrix-free solutions that are sufficient for analysing particulate matter with Ni concentrations approaching background levels (<0.001 $\mu g/m^3$). A source specific apportionment of Ni in $PM_{2.5}$ can be calculated based on the Ni isotope ratios and absolute Ni concentration. Comparison of initial results to the mineralogy of the source materials and baseline PM_{10} shows excellent promise for employing this Ni isotope procedure for characterizing $PM_{2.5}$ in larger, dust sampling campaigns designed to suppress fine emissions.