

## **COLUMBITE AND TANTALITE MINERAL DECOMPOSITION USING AMMONIUM -BI-FLUORIDE FUSION: ICP-OES DETERMINATION OF Nb, Ta, Ti, Fe, Mn, Sn, W, Zr AND REE'S**

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### **Abstract**

A simple and fairly rapid sample decomposition procedure for columbite and tantalite minerals using ammonium bifluoride ( $\text{NH}_4\text{HF}_2$ ) fusion, and preparation of a very stable solution, suitable for elemental analysis of major, minor and trace elements is developed. The sample solution is free from easily ionisable alkali elements like Na and K which are encountered during sample decomposition procedure and suppress the signal intensities due to non-spectral interferences, hence ICP-OES is suitable for the accurate elemental analysis of these minerals which also helps in assessing their economic value. The rare earth elements (REEs) which are present in trace levels are selectively and efficiently separated by cation exchange separation method and determined by ICP-OES. The utility of the proposed method is validated using certified reference materials like columbite-IGS-33 and tantalite-IGS-34 (obtained from the Institute of Geological Sciences, UK). The method is further validated by applying the z-test against the three reported decomposition methods and by observing that the z-scores are within  $\pm 3$ . F test shows that precision of the present method compares statistically well with the reported methods. Recovery studies of REEs on synthetic columbite and tantalite samples prepared in the laboratory indicates that the method is accurate. The percentage relative standard deviation (RSD) obtained for Nb, Ta, Fe, Mn and Ti are in the range of 0.9 to 3.6%; Sn, W and Zr are in the range of 6.5 to 8.9%; and for the REE's studied vary from 5 to 6.9% depending on the concentration of individual rare earth elements.

*Keywords:* Columbite, Tantalite, Ammonium bi-fluoride fusion, REE's, Cation exchange separation, ICP-OES determination.