

ANALYSIS OF SAPPHIRE AND RUBY BY EDXRF

Richard E. Phillips, Thermo Scientific

Christopher M. Breeding, Ph.D, G.G., Gemological Institute of America

Doped synthetic sapphires were evaluated for their efficacy in performing Energy Dispersive X-ray Fluorescence (EDXRF) analysis for trace elements in unknown sapphire and ruby samples. Synthetic sapphires were grown and doped with Fe, Ti, Ga, Cr, and V in order to have proper matrix matched geochemical analytical standards. These lab grown samples were produced by the Czochralski (or pulled) method of corundum synthesis, which is known to produce a very uniform product. Small variations in trace element chemistry can have important implications for detecting treatment in ruby and sapphire and for determining the geographical locality from which they were mined.

The standards were carefully tested for homogeneity using a grid of several hundred Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) analyses in three dimensions. The absolute concentrations were established by Secondary Ion Mass Spectroscopy (SIMS) analysis using ion-implanted sapphire standards of well constrained composition. Initial testing results using EDXRF confirmed that the standards are feasible for this technique, however variation among internal company laboratories was quite large (50% differences) using the same instrument and standards. Optimal analysis parameters were established and implemented in order to reduce the poor reproducibility of data between the laboratories. Based upon this work, inter-laboratory reproducibility was reduced to less than 10%.

The abstract is being submitted for the DXC conference and we grant you permission to post the abstract on the DXC web site and affiliated web sites.

Speaker:

Richard E. Phillips

XRF Applications Specialist

Thermo Scientific

1400 Northpoint Parkway

West Palm Beach, FL 33407

Ph: (561) 687-6159

Fax: (561) 688-8736

rich.phillips@thermofisher.com

We would prefer oral presentation in the EDXRF session. If not, poster presentation should be in the XRF poster session. We plan to publish this paper in the DXC proceedings.