Infrared Spectroscopy of Natural, Synthetic and Treated Rubies

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The widespread availability of chemicals, raw materials, and equipment capable of controlling multi-stage pressure and temperature conditions has made distinguishing treated and synthetic gems from their natural counterparts increasingly challenging. Traditional methods reliant on physical and optical characteristics often fall short in such scenarios. However, recent advancements in non-destructive analytical techniques, including EDX-SEM, XRD, RAMAN, AFS, LA-ICPMS, NMR, and FTIR, offer promising avenues for differentiation. For instance, identifying diamonds treated under high pressure and temperature solely through physical and optical properties poses significant risks and challenges. However, techniques like AFS and FTIR provide reliable means for differentiation. Similarly, the detection of beryllium diffused ruby and sapphire is facilitated by LA-ICPMS and WDX-XRF. FTIR, which measures the vibration energy of atoms within crystals, gemstones, and minerals, offers intricate fingerprint information crucial for identification purposes. Whether dealing with synthetic, pressure-treated, or temperature-treated loose or mounted gems, FTIR proves invaluable in differentiation. To evaluate the efficacy of FTIR in gemstone identification, we conducted tests on five natural, five synthetics, and five treated ruby specimens, obtaining distinct lattice vibration infrared spectra. These spectra effectively distinguished synthetic and treated rubies from their natural counterparts.