

Emerald treatment characterization: Addressing a jewelry trade crisis.

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Many emeralds in the gem trade have had air-filled fissures impregnated with viscous liquids to make those fissures less prominent. Several questions arise about any filled emerald: What and how much is present? What is the effect on appearance? How permanent is it? Ideally, these questions should be answered without affecting the appearance of the stone.

We studied 39 emerald filling materials as isolated substances. These represented six substance categories: essential oils, other oils, waxes (which could be natural), epoxy prepolymers, other prepolymers, and hardened polymers (artificial substances). The substances could be placed into five IR and Raman spectral groups; however, boundaries between spectral groups do not coincide with the boundaries of substance categories. Most individual fillers could not be distinguished by spectroscopic techniques, and in general we could not separate "natural" fillers from artificial ones.

With regard to fillers, nearly unmeasurable amounts (e.g., less than 0.001 ct for 0.5-1 ct stones) are typically added to emeralds. However, the effects on appearance can be substantial. As the refractive index of the filler approaches those of emerald, the filled fissures become significantly less prominent, although "flash effects" and trapped air will give them away.

Treatment durability problems have been noted by jewelers for many decades; with more volatile fillers, often these are dealt with simply by having the emeralds re-filled. However, more viscous fillers have been associated with worsened appearance as well, and these are difficult to remove for replacement.