HYDROTHERMALLY GROWN RUBIES AND SAPPHIRES: GEMOLOGY AND GROWTH CONDITIONS.

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Hydrothermal synthesis is a recent technique to grow gem-quality corundum crystals. The addition of traces of transition metal ions into experimental solutions allows one to produce corundum of varying color, in particular, rubies and blue sapphires. The most important properties of hydrothermally grown corundum are the same as those of their natural counterparts. Most distinctive features are unusual growth patterns and color distribution. Some hydrothermally grown sapphires differ from natural ones in the nature of color. Their major distinction from flux and melt grown synthetic sapphires is the presence of C – O absorption lines in infrared spectra.Close physical properties of natural and hydrothermally grown ruby and sapphires are due to the use of experimental solutions similar in composition to the natural ones. CO2 is one of the major components both in natural and experimental growth systems. It plays an important role in Al and Cr transport under hydrothermal conditions. Morphology of growth surfaces, presence/absence of different crystal faces, trace element composition of corundum and crystal imperfections are in strong relation to the supersaturation and Mg, Mn, Fe, Cr and Si content in the solution. Rapid growth of a hydrothermal corundum onto a nonsingularly oriented seed results in the appearance of internal growth pattern, which is different from the growth zonation of natural corundum. Crystals, which grow slowly onto singularly oriented seeds have the growth zonation similar to that in natural ones.The data obtained from this study can help to investigate the conditions of gem-quality corundum formation in nature.