AOGS 2006

Structural Defects in Sapphire Crystals from Shantung, PR China

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The real crystal structure of a mineral may be affected by the growth environment, including crystallization conditions and geological evolvement etc. . Several instruments and methods, such as polariscope, synchrotron radiation white light micro-topography analysis and transmission electron microscope, are used to apply small scale material research on sapphires occurring in Shantung Province (PR China) focusing on the phenomenon of optical abnormity, structural defects, and structural characters of differently colored sapphires. Different degrees on the phenomena of optical abnormity are observed in the vertical direction to the c-axis with the conoscopic polariscope. Usually, uniaxial interference figures change to an appearance of biaxial optically negative character of sapphire with a small 2V-angle; mentionable, comparing with the thus observed 2V-angle of blue-tinted sapphires, that of tan sapphire appears to be larger. The results of synchrotron radiation white light micro-topography analysis show that different sapphires have different structural defects and the degree of defects may vary with different directions even in the same area in samples. Generally, distortions in tan sapphires are more pronounced than that in blue-tinted sapphires. There are a few obvious defects in blue sapphire observable with the transmission electron microscope. However, the tan sapphires show large numbers of linear and surface defects, such as displacement loop, displacement line, displacement mesh, crystal boundary, sub-grain etc. There are lots of micro-inclusions in the sapphires. The distributing density, at most, is about 107/mm3. The sapphires occurring in basalts in Shantung, China, have different kind and number of structural defects. The overall interior structural characters, the information from defects, the relationships between the magnificent macro-physical character and the micro-structural defects, may be of great importance for crystal formation mechanism in distinct geological settings. Proper enhancement procedures have to be applied to optimize the properties of Shantung sapphires for gemstone purposes.