Using Mössbauer spectra to characterize and differentiate tourmaline crystals from China

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Tourmaline is a valuable crystalline raw material notable for its piezoelectric and pyroelectric properties. It is also regarded as precious stones in jewlry industry. Tourmaline occurs in almost all types of geologic circumstances and coexists with numerous minerals. Consequently, chemical variation of tourmaline is tightly related with its crystal structure and physical properties which provides important constraints on the origin of tourmaline. Mössbauer spectra analysis has been playing an important role in the detailed study of isomorphic substitutions in tourmaline crystal by Fe^{2+} and Fe^{3+} and the distribution of these ions over distinct crystallographic positions. Nevertheless, the traditional researh on Mössbauer parameter of tourmaline crystals has great uncertainty in the determination of the valance states and occupation types by the expecience values.

In this contribution, the multi-statistic method of cluster analysis was used to effectively determine the Mössbauer spectra and examine microscopic structures of Fe ions in different tourmaline crystals from Guangxi, Hebei, Neimeng and Xingjiang Provinces where have much variable geologic background. The determined assignment corresponds well with previous documented results. We observed four kinds of distribution styles of iron (Fe) ion in the measured tourmaline samples, which distinctly occupy four zones in the diagram of isomer shift and quadrupole splitting. The tourmaline crystals from Guangxi, Hebei and Neimeng are characterized by similar Mössbauer spectra bearing three doublets, which correpand to Fe^{2+}(Y), Fe^{2+}(Z) and Fe^{3+}(Y) sites with two kind of valances respectively. In comparison, only two doublets appear in the Mössbauer spectrum of Xinjiang tourmaline, and the Fe ions having bivalence states occupy Fe^{2+}(Y) and have a neighborhood effect in the Y-Z site. Our study on Mössbauer spectra together with scanning electronic microprobe analysis clearly suggests these tourmaline crystals sourced from different areas have variable compositions and crystalline structures indicative of their different origins.

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Long term aerosol trends over large global urban centres

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Aerosol Optical Depth (AOD) retrieved from MODIS and MISR sensors onboard EOS Terra satellite over the last decade (2001-2010) has been utilized to analyze aerosols trends over global megacities. Analysis provides an assessment of retrieval capabilities of these sensors. Level 2 data sets have been carefully analyzed over selected urban centers to understand the retrieval capabilities of these two sensors over complex urban surfaces. Areas over each urban center have been identified, where MODIS operational algorithm is unable to retrieve AOD due to limitation of dark target approach. MISR aerosol product has been used to identify dominating aerosol size distribution and type, as function of seasons. Spatial gradient in AOD within and around the city has been estimated as well. Impact of spatial and temporal averaging over long term trends will also be addressed.

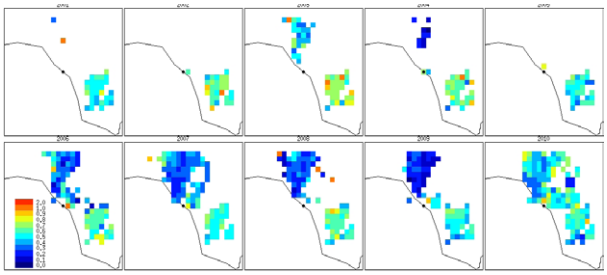

Figure 1: Annual mean aerosol optical depth from MODIS (Terra) over Karachi, Pakistan for 2001 to 2010.