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A Community Database of Quartz Microstructures: Can we make measurements that constrain rheology?

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Rheology can be explored by performing deformation experiments, and by examining resultant microstructures and textures as links to naturally deformed rocks. Certain deformation processes are assumed to result in certain microstructures or textures, of which some might be uniquely indicative, while most cannot be unequivocally used to interpret the deformation mechanism and hence rheology. Despite our lack of a sufficient understanding of microstructure and texture forming processes, huge advances in texture measurements and quantification of microstructural parameters have been made. Unfortunately, there are neither standard procedures nor a common consensus on interpretation of many parameters (e.g. texture, grain size, shape preferred orientation).

Textures (crystallographic preferred orientations) have been extensively correlated to the interpretation of deformation mechanisms. For example the strength of textures can be measured either from the orientation distribution function (e.g. the J-index (Bunge, 1983) or texture entropy (Hielscher et al., 2007)) or via the intensity of polefigures. However, there are various ways to identify a representative volume, to measure, to process the data and to calculate an odf and texture descriptors, which restricts their use as a comparative and diagnostic measurement.

Microstructural parameters such as grain size, grain shape descriptors and fabric descriptors are similarly used to deduce and quantify deformation mechanisms. However there is very little consensus on how to measure and calculate some of these very important parameters, e.g. grain size which makes comparison of a vast amount of precious data in the literature very difficult.

We propose establishing a community database of a standard set of such measurements, made using typical samples of different types of quartz rocks through standard methods of microstructural and texture quantification. We invite suggestions and discussion from the community about the worth of proposed parameters, methodology and usefulness and willingness to contribute to a database with free access of the community. We further invite institutions to participate on a benchmark analysis of a set of ‘standard’ thin sections.

Bunge, H.J. 1983, Texture Analysis in Materials Science: mathematical methods. Butterworth-Heinemann, 593pp.
Hielscher, R., Schaeben, H., Chateigner, D., 2007, On the entropy to texture index relationship in quantitative texture analysis: Journal of Applied Crystallography 40, 371-375.