

**COMPARISON OF ABSOLUTE AND RELATIVE CUTTING
ANGLE MEASUREMENTS OF AT CUT QUARTZ
BY MEANS OF THE Ω -SCAN METHOD**

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For many years, the X-ray W-scan Method has been successfully applied to the crystallographic orientation determination of AT-cut as well as of doubly rotated blanks [1]. The method used for AT-cut blanks up to now is a relative one referring the cutting angle to that of reference specimens. However, for physical interpretations and the comparison of the orientations of various charges the absolute values, i.e. the true physical cutting angles and XX' miscutting angles, should be known. In principle, the X-ray data of the W-Scan Method can be evaluated in an absolute mode in any case, without need of reference blanks. So, the orientation of SC, IT and FC-cut blanks is determined absolutely. Also for the new developed modular X-ray sorting machine for AT-cut blanks, the so-called "Carousel" [2], the absolute evaluation is employed. A comparison of the results of three variants, the relative as well as the absolute evaluation of measurements performed on the conventional AT machine and that of measurements on the "Carousel", using the same set of AT-cut blanks will be reported.

Whereas the influence of systematic errors is compensated to a wide extent if the results are referred to reference blanks, for the absolute measurements the errors due to the relatively broad and asymmetric X-ray reflection curves caused mainly

by the divergence distribution of the primary X-ray beam have to be corrected exactly [3]. Different models describing these distributions and corresponding simulation calculations have to be applied for both machines.

The absolute evaluation of the measurements leads to reliable orientation parameters, not only for the "Carousel" but also for the conventional machine. The differences of the corrected cutting angles as well as the XX' miscutting angles between both machines do not exceed few arcseconds. The given cutting angles of reference blanks are factory-specific data. In this study, the difference between the cutting angles of the test blanks determined as relative values and the absolute ones amounts in one charge 35 arcsec. and in a second charge 50 arcsec.

[1] H. Berger, H. Bradaczek, H.-A. Bradaczek, G. Hildebrandt; Proc. 1986 IEEE Int. Freq. Contr. Symp., Honolulu, Hawaii, 412-415.

[2] H. Berger, H.-A. Bradaczek, H. Pianowski, H. Bradaczek; Proc. 2000 IEEE/EIA Int. Freq. Contr. Symp.; Kansas City, Mo., 247-249.

[3] H. Berger, H. Bradaczek, G. Hildebrandt; Proc. 19th Piezoelectr. Dev. Conf., Kansas City, Mo., 15/1 - 15/23.