B45   Does the Edge Count Matter? Examining the Effect of the Edge Count on GRIM 3 Measurements

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The goal of this presentation is to examine the significance of the edge count and how this quantity affects measurements taken by GRIM 3 (Glass Refractive Index Measurement). In addition, this presentation will examine some of the factors that can affect the measurement of the edge count.

This presentation will impact the forensic community and/or humanity by providing glass examiners with guidance as to when they should accept or reject measurements made by GRIM 3 based on the edge count obtained.

The ability of GRIM 3 to perform four measurements simultaneously can greatly reduce the time required to accomplish an analysis. However, it is not always possible to position the slide in such a way that four fragments with high contrast edges are available that will result in measurements with maximum edge count. The question then arises as to how the measurement of match temperature is affected when less than ideal edges are examined.

In order to isolate the effect of edge count on match temperature as much as possible, the initial analyses were performed on optical glasses. Furthermore, very small fragments of glass were used in order to minimize the effect of any intrinsic inhomogeneity. Additional measurements were performed on samples of annealed and tempered glass to represent glass found in casework. All of these measurements were taken using a ramp rate of 4°C/min. The data was analyzed by classifying the measurements into five groups based on the edge count (0-24, 25-49, 50-74, 75-98, and 99) and comparing the mean and standard deviation (SD) of the match temperature for each group for each glass. GRIM 3 also allows for different temperature ramp rates to be used (1, 2, 4, and 5°C/min). The effect of the ramp rate on the edge count was also examined by taking measurements of the exact same edges at all four ramp rates.

The results of this study show that only for groups with edge count (0-24) and (25-49) was the mean match temperature significantly higher than for the edge count 99 group. An edge count of 99 produced the lowest standard deviation in match temperature for all glasses, with the standard deviation increasing with decreasing edge count. This increase in SD, relative to the group with an edge count of 99, was small (less than 5%) for samples in the group with edge count (75-98). The results of the ramp rate measurements demonstrate that the edge count is strongly dependent on the ramp rate. The slower the ramp rate is, the lower the resulting edge count. It was also found to be very difficult to achieve a high edge count for ramp rates of 1°C/min and 2°C/min

Based on these results, to achieve optimal accuracy and precision when using GRIM 3, obtaining an edge count of 99 for all measurements is ideal. However, the additional variation introduced by accepting edge counts in the range (75-98) is small. Therefore it is suggested that, in order to achieve optimal accuracy and precision (and in the absence of any other complicating factors), a minimum edge count of 75 should be obtained when taking measurements with GRIM 3. In addition, the examiner must be aware of the strong effect the ramp rate will have on the edge count.

Glass, GRIM, Refractive Index