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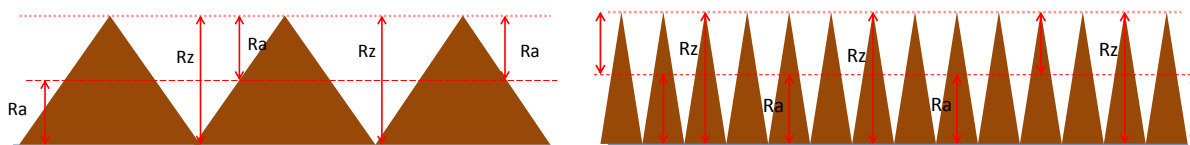


Fig. 13 - These Surfaces have the same Ra and the same Rz

Rz measurements typically have greater variation than other parameters, due in part to the measurement of only the five highest peaks and the five lowest valleys. Rz measurements are influenced by surface scratches and typically have the highest variation. All the surfaces shown have the same Rz, but not the same surface length. (Fig 14)

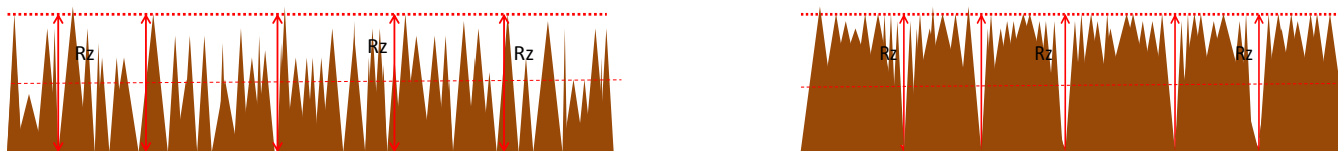


Fig. 14 – These surfaces have the same Rz

Conclusions

We have found that using Light Interferometry Surface Roughness Measurement provides Ra, RSAR and Rz measurements for controlling inner layer copper roughness before lamination to assure in range condition of pre-established conductor losses. RSAR is the most useful for providing accurate data of the smaller (micro roughness) features imparted by the oxide alternative process or other chemical roughening processes and Ra measurements provide accurate data of the larger (macro roughness) features. Rz measurement only shows the maximum surface roughness and can be somewhat misleading, having sensitivity to any scratches or surface defects. However Rz is helpful in assessing overall non-uniformity by the relationship with Ra. Additionally, Rz can be measured by cross-section of the inner layer side of the foil to provide an “As received” record of the previously laminated foil side.

We have seen the correct preparation (grinding and polishing) of cross-sections to be critical in obtaining reasonably accurate Rz numbers of the macro-roughness. Determination of the gain in surface roughness through Oxide Alternative process, before lamination, can provide process control data through the process. Additionally, the program provides Standard Deviation and Coefficient of Variation % data for SPC. Analyzing the raw measurement data with no reduction in micro roughness from high frequency filtering and minimal low filtering, provides accurate, optimized measurements of the copper surface. RSAR and Ra together provide an accurate measured representation of the micro roughened copper surface following Oxide Alternative Process and are suitable for process control.

References

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