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Effects of bulk material properties on RF surface resistivity

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Several concepts for future linear colliders are dependent on very high gradient normal conducting RF cavities achieved by operation at cryogenic temperatures in order to reduce breakdown rates (BDR). These maximum fields are intended to be in excess of 200 MV/m. The concepts include the ultra compact Xray free electron laser and the C^3 collider. The theory involved with the complex physics of breakdown is a diverse and rich field of study. Most results are empirical so continued understanding of the phenomena becomes necessary. One contributing factor to the reduced BDR is the increased hardness at cryogenic temperatures of the copper. in order to test that assumption we can consider obtaining hardness improvements from the alloying of copper with silver. We will here present a preliminary theory of this alloy based improvement especially with respect to an improved understanding of the surface resistivity using our previously established theory improvements which go beyond the usual Reuter and Sondheimer explanation. We will compare this to quality factors measured in Cband pillbox cavities as a function of temperature.

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Footnotes

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