

Thermal Heating of Biological Crystals Subjected to X-ray Beams of High Flux Density: Theoretical Modeling and Analysis

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The problem of thermal heating in biocrystals when exposed to high intensity x-ray beams is a serious concern in the field of x-ray crystallography of biological samples. Rigorous theoretical analysis to predict the resulting thermal behavior in biocrystals during beam heating is considered in depth in this presentation. More specifically, the first objective of this talk will be to quickly provide an overview the relevant mathematical theory of heat transfer as applied to biocrystal heating and to present the applicable theoretical solutions to the problem of interest. Based upon the above, the next major goal, and main focus of this presentation, is then to report and discuss several very specific examples of biocrystal heating calculations showing the expected temperature level rise and distribution within the sample for a range of operating conditions. Finally this talk will conclude with a brief summary / assessment of the key thermal parameters pertinent to the biocrystal heating problem, with particular emphasis on their impact toward improved thermal control, and recommendations for future thermal studies work.