Modifying Crystal Properties of Naturally Grown Cuprous Oxide through Controlled Heating

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Excitons are elementary excitations in various electronic systems. They play a fundamental role in solid-state quantum technology and the development of new optoelectronic devices. Furthermore, the optical properties of excitons in Cuprous Oxide (Cu_2O) are of significant interest in precision sensor technologies because Rydberg excitons with large quantum numbers n can be generated in this material [1]. Thus, improving the quality of this semiconductor is a critical area of research in the field of electronics and optoelectronics as it directly affects the performance of devices made from this material. Our collaboration with the Johannes Gutenberg University Mainz [2] enables us to explore the impact of thermal processes on the crystal structure of Cu_2O. The primary goal is to enhance crystal quality, with a specific focus on understanding impurities within the crystal. To investigate the interactions between excitons and impurities, we prepare various samples derived from the same mother crystal. Each sample is measured, and we record both the absorption spectra and photoluminescence (PL). These samples are then dispatched to Mainz, where they undergo a heating process at diverse temperatures. After treatment, the samples are returned for further analysis, revealing the resulting changes. The heated samples exhibit variations in both absorption spectra and photoluminescence spectra. These measurements reveal changes in the distribution of impurities within the material.

References

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