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Field emission arrays characterised by x-ray photoemission electron microscopy

The phenomenon of field emission has been known for some 100 years with cold emission electron sources being exploited for their high brightness in fine-focus applications such as microscopy, high-density information recording, micro-fabrication, flash x-ray devices, and flat panel displays. The last decades has witnessed a renaissance in materials development and potential use of these devices. And yet much of the familiar questions that seek to relate emission quality with surface structure and chemistry remain unanswered. Photoemission microscopy using soft x-rays produced from a synchrotron has the potential to revolutionise the characterization of many aspects of field emission devices because both emission character and surface structure and chemistry may be directly obtained and correlated. This study reports some of the first steps towards such a goal. Field induced emission character, chemical composition, and morphology of low work-function Cu-Li/Si arrays are spatially studied and correlated. Results clearly show highest emission occurs at the sharpest edges of the structures that are covered by the alloy, thus opening the door for systematic studies into fundamental structure-function problems of such advanced functional materials under operating conditions.

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