2708
doi:10.1017/S1431927621009545
Microsc. Microanal. 27 (Suppl 1), 2021

Expanding the capabilities of the RF stroboscopic TEM

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In the last several years, this collaboration has succeeded in prototyping and demonstration [1, 2] of a new class of time-resolved transmission electron microscopes, the laser-free RF stroboscopic TEM. These microscopes, using an award-winning RF technology [3, 4], had previously delivered periodic pulses of electrons between 40 MHz to 12 GHz, with demonstrated temporal resolution of between 10 ps to 30 ps. We have since successfully imaged the injection of a microwave into an interdigitated MEM device [2, 5].

In this work, we demonstrate that a full range of periodic electron pulses spanning 9 orders of magnitude (from 1 Hz to 12 GHz) with the concomitant lengthening of pulse widths with decreasing frequencies, can be achieved. Additionally, we have made ecosystem improvements such as high-fidelity signal delivery vias an improved broadband specimen holder and an upgrade in the system engineering and control integration. These new capabilities broaden the menu of phenomenon that is accessible with the RF-class microscopes. With the new flexibility, one area of focus is the physics of beam-specimen interaction. We will discuss how a temporally modulated beam alters the disintegration of organic molecules and the crystallization of vitrified amorphous ice.

References

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