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Dental Photothermal Radiometry: Theoretical Analysis. ANNA MATVIENKO, RAYMOND JEON, ANDREAS MANDELIS, Center for Advanced Diffusion Wave Technologies, University of Toronto, Canada, STEPHEN ABRAMS, Four Cell Consulting, Toronto, Canada — Dental enamel demineralization in its early stages is very difficult to detect with conventional x-rays or visual examination. High-resolution techniques, such as scanning electron microscopy, usually require destruction of the tooth. Photothermal Radiomety (PTR) was recently applied as a safe, non-destructive, and highly sensitive tool for the detection of early dental demineralization, artificially created on the enamel surface. The experiments showed very high sensitivity of the measured signal to incipient changes in the surface structure, emphasizing the clinical capabilities of the method. In order to analyze the biothermophotonic phenomena in a tooth sample during the photothermal excitation, a theoretical model featuring coupled diffuse-photon-density-wave and thermal-wave fields was developed. Numerical simulations identified the effects on the PTR signal of changes in optical and thermal properties of enamel and dentin as a result of demineralization. The model predictions and experimental results will be compared and discussed.

Anna Matvienko
Center for Advanced Diffusion Wave Technologies, University of Toronto, Canada

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