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Quantitative study of stress levels in AT and BT cut quartz crystal microbalances associated with surface laser irradiation.[1] L.H. GOODMAN, E.S. BILILIGN, B.J. MCCANN, B.W. KELLER, K. STEVENS, S.G. KENNY, J. KRIM, North Carolina State University — The frequency response of an AT cut Quartz Crystal Microbalance (QCM) to laser irradiation has been increasingly studied in recent years, as the combination of photons with materials on a QCM's electrodes enables fundamental studies of topics that span biophysics to photovoltaics. In order for such studies to advance, however, the impact of heating effects associated with laser irradiation of the QCM must be accounted for. Prior studies reached qualitative conclusions that laser irradiation induces stress QCM's arising from non-uniform thermal expansion, but did not quantitatively measure the degree of stress. Secondary effects such as surface film desorption and/or changes in temperature were also reported to be present. We report here a study of the frequency response of AT and BT cut QCM's to laser irradiation. AT and BT cut QCM's have similar response to mass adsorption, but opposite frequency response to stress levels, allowing the stress levels induced by the laser light to be quantitatively measured when the results are compared. Studies were performed in both vacuum and air, to control for the presence of adsorbed films. As expected, system designs that minimize temperature gradients result in less of an effect.

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