

# Laser Excitation for Raman and Fluorescence Imaging

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# Hyperspectral Imaging Using Laser Excitation for Fast Raman and Fluorescence Hyperspectral Imaging for Sorting and Quality Control Applications

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A hyperspectral measurement system for the fast and large area measurement of Raman and fluorescence signals was developed, characterized and tested. This laser hyperspectral imaging system (Laser-HSI) can be used for sorting tasks and for continuous quality monitoring. The system uses a 532 nm Nd:YAG laser and a standard pushbroom HSI camera. Depending on the lens selected, it is possible to cover large areas (e.g., field of view (FOV) = 386 mm) or to achieve high spatial resolutions (e.g., 0.02 mm). The developed Laser-HSI was used for four exemplary experiments: (a) the measurement and classification of a mixture of sulphur and naphthalene; (b) the measurement of carotenoid distribution in a carrot slice; (c) the classification of black polymer particles; and, (d) the localization of impurities on a lead zirconate titanate (PZT) piezoelectric actuator. It could be shown that the measurement data obtained were in good agreement with reference measurements taken with a high-resolution Raman microscope. Furthermore, the suitability of the measurements for classification using machine learning algorithms was also demonstrated. The developed Laser-HSI could be used in the future for complex quality control or sorting tasks where conventional HSI systems fail.