

Examination of Deposits on Macroscopically Rough Metal Surfaces by IR Microspectroscopy

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INTRODUCTION

IR Microspectroscopy is a well-known tool for the examination of intact materials on metal surfaces. It is important to examine the material as manufactured or deposited in order to preserve all clues to the origin of the material and to the mechanism of deposition. Macroscopically rough surfaces present an additional challenge because the reflected light may not be sufficient for detection by commercially available IR microscope equipment.

INITIAL RESULTS

The initial candidate parts were fuel injectors because their surfaces are either highly curved or very rough. Using ALS beam 1.4.3 and the associated Nicolet Spectrometer and microscope, interpretable spectra were almost always acquired in contrast to about a 25% rate for conventional commercial apparatus. The composition of this material is typical of a fuel non-volatile residue.

The true utility of the ALS instrument was the ability to obtain useable spectra from the curved surfaces after removal of fuel soluble components. The estimated total weight of the under deposit is 100 ng spread over the bottom half of a sphere of about 1 mm diameter. The same material is thought to be present on a steeply sloping mount for the sphere. No spectra were obtained from the mount surface due to our inability to position the surface in a favorable geometry.

Efforts to interpret the IR spectra and other analytical experiments are under way but are not yet complete. However, the ALS spectra provided direction of what to try next. Efforts are also under way to construct a device that would aid in positioning the intact injector body such that the inner rough conical surface presents enough of a plane for detectable reflection of IR radiation from the surface.