9th International Conference on NDT of Art, Jerusalem Israel, 25-30 May 2008
For more papers of this publication click: www.ndt.net/search/docs.php3?MainSource=65

# INFRARED SPECTROSCOPIC ANALYSIS OF MATERIALS IN CONSERVATION AND ARCHAEOLOGY

Steve Weiner
Department of Structural Biology and the Kimmel Center for Archaeological Science,
Weizmann Institute, Rehovot, 76100 Israel

Infrared spectroscopy is a powerful tool for analyzing both organic and inorganic materials, including crystalline and amorphous minerals. It requires about a tenth of a milligram of material, and samples can be prepared and analysed within a few minutes. Even though it is not non-destructive, the small amounts of material required are often compatible with performing analyses of even valuable artifacts. There are many applications of infrared spectroscopy in the field of archaeology and conservation. A few examples will be given.

Identifying different classes of organic macromolecules, such as proteins, polysaccharides, lignin, resins and so on, is usually possible. Within these classes, further differentiations can be made, such as distinguishing between chitin and cellulose, collagen and other proteins. Furthermore, relative proportions of cellulose and lignin in fossil wood can be assessed, which then provides information on the relative states of preservation of fossil wood samples.

Almost all minerals can be identified using infrared spectroscopy. Because infrared spectroscopy is sensitive to disorder in the crystal lattice, differently ordered phases of the same mineral can be differentiated. This capability has many applications in archaeology. For example in the identification of plaster as opposed to geogenic calcite; the identification of clays that have been exposed to elevated temperatures, and bones which have been cremated.

The infrared spectrum of bone mineral itself is most informative. It can provide information on the presence or absence of collagen, the crystallinity of the mineral phase, the approximate proportions of carbonate as compared to phosphate, and whether fluoride has entered into the crystal lattice.