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Determining Processing Impact on Reflectivity of Electroplated Nickel

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RCEU Proposal: Determining processing impact on reflectivity of electroplated nickel

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Project Summary

Nickel replicated optics have been shown to be highly effective in a broad range of optical applications. From the production of simple lamp projectors, lightweight x-ray optics, and non-imaging optics for fire detection systems, these elements have provided low cost, high quality optics. One application in particular, early fire detection systems, requires sufficiently high reflectivity in the UV spectral range. This is often difficult to achieve without employing expensive and delicate coatings which makes their use impractical due to environmental degradation from humidity, rain and even common pollutants. One potential means of increasing the reflectivity is to alter the amount of phosphor in the replicated nickel. This project will provide data on the spectral reflectivity variations that result from changing the nickel / phosphor ratio in these mirrors. The student will perform a series of experiments utilizing a spectrophotometer and a spectrometer to measure and document these reflectivity variations

Over the course of this program, the student will learn by instruction, independent review and independent laboratory activity the methods, purpose and approaches for measuring spectral reflectivity of samples. For each separate experiment, the PI will provide an overview of the fundamental basis of the measurement and training in its implementation. The student will perform computer based surveys to provide a fuller understanding for each method and will physically perform each experiment. Lecture notes and the computer survey will provide a basis for a report written for each experiment, with the results of that experiment documented and analyzed. The individual results will form sections for a summary report comparing the different tests, focusing on what unique information each test provides, and how will the same information correlates between tests. The student will also learn the basic process steps and material issues of Ni plating for optical components.

Student Prerequisites

The student must have a science and/or engineering background. Experience in using computers is a necessity, and programming, such as MatLab, is desired. Courses in geometrical optics and/or physical optics would be an advantage.

Student Duties

The student will be responsible for taking measurements using a minimum of two optical instruments, a spectrophotometer and a spectrometer. The student must follow all rules for safety and proper lab techniques for each measurement. The student will be responsible for fully documenting and recording all data taken during the program. The student will perform brief research into each test in order to more fully understand the experiments being performed.

Mentor Supervision and Interaction

The PI will provide training and assistance for all optical tests being performed. This will include both a lecture format and lab training. Meetings will nominally be occurring daily. The student will also interact with CAO staff and graduate students who can provide assistance with locating necessary optical components and operating the equipment.