

## FRANKLIN RESEARCH INSTITUTE

Permanent Bond Test

“Our experiments show the coating is 1 to 2 microns thick and bonded to the surface.”



FRANKLIN INSTITUTE RESEARCH LABORATORY, Inc.  
A Subsidiary of The Franklin Institute

Mr. D. Gernert  
Energy Independence Assoc.  
325 West Swedesford Road  
Exton, Pa. 19341

Subject: FIRL, Inc. Project 031-A5465-01 (1731)  
Engine Treatment Product

Dear Mr. Gernert:

We selected a wrist pin from the engine parts you sent us. The pin was sectioned into the three parts with a cut off wheel. One part was cleaned in a ultrasonic cleaner and then nickel coated, another uncleaned part was also covered with nickel, while the third part's surface was studied with no preparation.

All three parts were studied in the Scanning Electron Microscope. The uncleaned, uncoated section is shown in Micrographs 1,2, and 3. The treated surface is seen in the upper part of the micrograph, the uncleaned nickel coated sample was studied next.

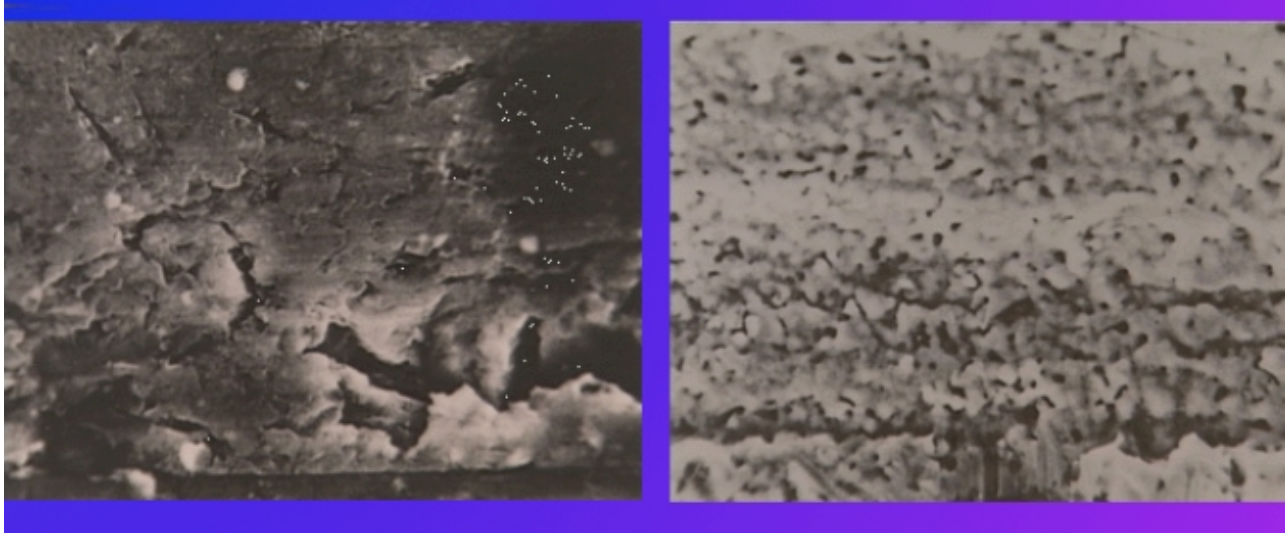
An elemental x-ray line scan was run on the interface between the nickel and the steel where the coating should be found.

Micrograph 4 shows the general area where the analysis was run. Micrograph 5 shows the results of the analysis. The bright straight line near the center of the micrograph is the exact area the was analyzed. The upper trace represents the relative amount of the element, which is the experiment, will show where the edge of the sample is located. The lower trace, which is the nickel, shows the location of the coating relative to the surface of the steel. The space between the peak iron reading and the peak nickel reading represents the thickness of the coating. Micrograph 5 was at 10,000X; therefore, 1 micron is measured as 1CM, which is the approximate distance between the nickel and the steel part.

The third sample which was ultra-sonically cleaned for about one quart of an hour to remove any surface material that may be on the surface, was studied next. The reason for the surface cleaning was to remove any unexpected material from the surface before the nickel coating is applied. We actually expected the product to also be removed, but later found it was still there. Micrograph 6 shows the same relationship as micrograph 5; the thickness of the coating again is measured 1 to 2 microns.

**The above experiments show that coating is to be 1 to 2 microns thick and bonded to the surface.**

Sincerely,  
H. Thomas Tucker



The image on the left shows a machined metal surface magnified 2,000 X from an Electron Microscope. Asperities, the peaks and valleys that you can clearly see under this magnification, remain evident. The image on the right is also of a machined metal surface after treatment. Note that the bonding is uniform and the asperities are still pronounced and not filled in. This permanently fused layer of dry lubrication measures only 1 - 2 microns in thickness and does not affect the machined tolerances in any engine or machinery.

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