

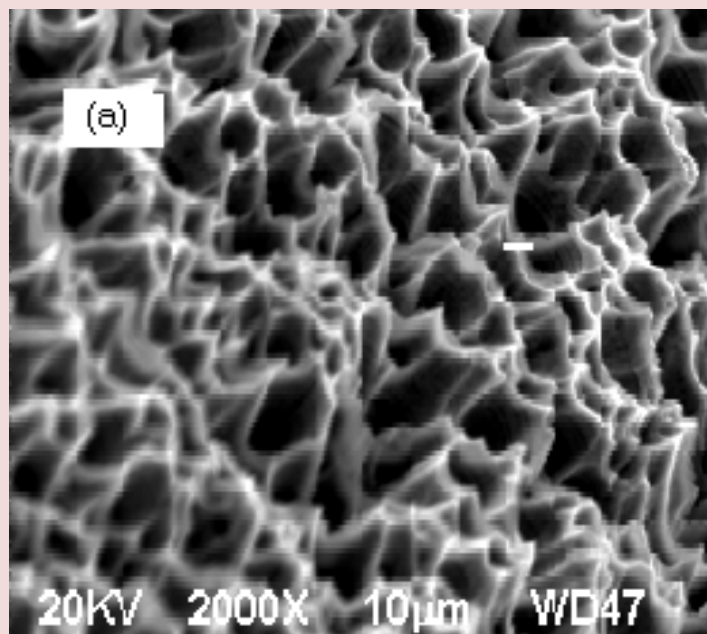
# ADVANCED TECHNOLOGIES FROM ISRO

Interest Exploration Note

TT / 10 / 01 / ISAC

## ULTRA HIGH ABSORBER BLACK ELECTROLESS NICKEL PLATING TECHNOLOGY

Indian Space Research Organisation at its ISRO Satellite Centre (ISAC), Bangalore has developed a process of electroless nickel blackening on Invar to produce ultrahigh solar absorber surface. The blackened Ni-P film provides higher solar absorptance in the order of 99.5% and is extremely suitable for optical instruments. These coating are produced by selective etching of electroless nickel coating in strong oxidizing acids.



### Specifications of Black Nickel Coating

Solar absorptance,  $\alpha_s$

~0.990, with bloom

~0.950, without bloom

The coating has a unique surface morphology consisting of dense array of microscopic, conical pores perpendicular to the surface. This structure acts as a light trap is capable of absorbing 99.5% light in solar region (300-2300 nm). The pore diameter, pore depth and pore spacing range from a fraction of micrometers to a few micrometers.

## Testing & Evaluation

Sl.No	Test Conducted	Test Specification	Result
1	Visual	4X	No Patches
2	Adhesion	Scotch Tape Test	Good Adhesion
3	Thickness	Micro Sectioning	Black Coating:35 to 45 $\mu\text{m}$ Ni-P : 40 to 50 $\mu\text{m}$
4	Micro Hardness	50 g load, 10 seconds	Black Coating : 575 VHN Ni-P : 590 VHN
5	Thermal Stability	200° C, 48 hrs	No discoloration and patches
6	Humidity	95 $\pm$ 0.5% at 50 $\pm$ 1° C, 48 hrs	No effect on coating
7	Corrosion	5 % NaCl , pH 7.0 , 7 days	Passed
8	Thermal Cycling	-45° C to +80° C, 100 cycles	No change in properties
9	Thermo Vacuum Performance	-45° C to +80° C 2 hrs,10-5 torr, 10 cycles	No change in properties, No degradation

## Application

1. Ultra high absorber black coatings are of paramount importance in the design of terrestrial and space borne optical instruments and sensors used for measurements in ultra violet, visible and infrared spectral regions.

2. Black paints with organic binders are not recommended for optical instruments for high vacuum applications due to their high total mass loss and condensable condensed material %. The black electroless nickel being an inorganic coating with negligible weight loss in vacuum conditions is an ideal choice in such applications

## TECHNOLOGY TRANSFER FROM ISRO

ISRO is willing to offer the technology of Ultra High Absorber Black Electroless Nickel Plating to eligible interested parties. Interested entrepreneurs / industries are requested to contact the address given below with all relevant particulars regarding their line of current activity, infrastructure available, market assessment of the product, financial arrangements made, turn over and sales of their products for the past years and a copy of their latest annual report.

For further details, please contact:

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