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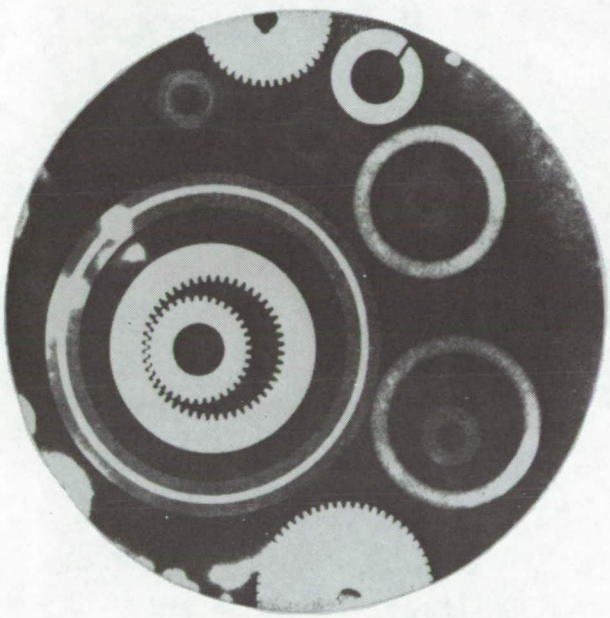
NASA TECH BRIEF

Lewis Research Center

Radiation-Induced Nickel Deposits

A new photographic-type process, based on the deposition of elemental nickel, resembles the common silver-deposition photographic process in that a latent image formed by the irradiation of an exposed coated surface can be amplified by development to produce a



Radiograph

permanent visible image of wide tonal gradation in the gray scale. The active compound in the surface coating is nickel hypophosphite which is sensitive to X-rays and electron radiation, but is not sensitive to visible light. This lack of sensitivity to visible light allows processing in daylight and eliminates the need for light-proof containers and darkrooms. In addition, the more abundant and less expensive nickel replaces the more costly silver used in the conventional photographic emulsions.

Experimental evidence indicates that nickel need not be present in the emulsion coating. The sensitive component may also be sodium hypophosphite, ammonium hypophosphite, lithium hypophosphite, or sodium phosphite; the nickel is supplied in the developer. The developing solution for these coatings requires the presence of both the divalent nickel ion and the hypophosphite ion.

This technique can be used in place of the conventional photographic process for copying, graphic arts, and radiography (see figure). Since nickel is deposited only on the areas exposed to radiation, the use of a suitable mask opaque to radiation allows selective deposition of nickel on a substrate. This feature can be used for such applications as making printed circuits. Adherent mirrors have been selectively deposited on smooth surfaces such as glass by coating the surfaces with a nickel hypophosphite solution containing an adhesive.

This process also allows the deposition of nickel throughout porous substrates such as fritted glass, blotting paper, and porous ceramics. Such deposits of nickel in porous substrates are useful as catalysts. Catalytically active nickel deposits have been prepared in porous materials by immersing the substrate in aqueous nickel hypophosphite, irradiating the dry material, and developing the material in aqueous alkaline solution. This process results in a finely divided, well distributed nickel deposit throughout the substrate. It was found that, when dilute aqueous ammonia was used as the developer, the deposit was more active as a catalyst.

Notes:

1. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $6.00
   (or microfiche $0.95)

   Reference:
   NASA SP-227 (N70-20860), Aerospace Structural Materials

(continued overleaf)

2. Technical questions may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B72-10456

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,658,569). Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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