Corrosion Inhibitors as Penetrant Dyes for Radiography

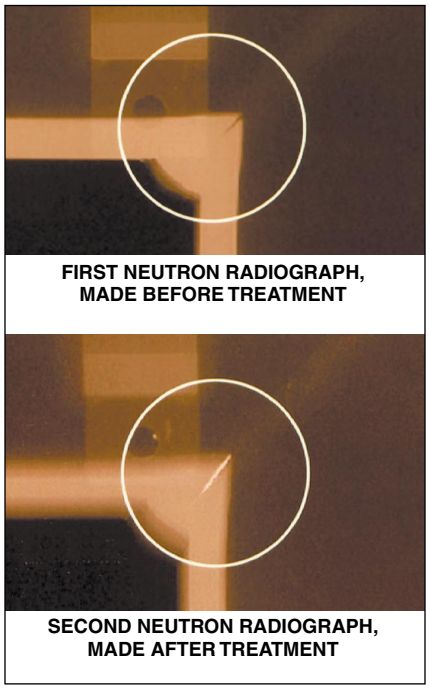
These substances now have dual uses.

Marshall Space Flight Center, Alabama

Liquid/vapor-phase corrosion inhibitors (LVCIs) have been found to be additionally useful as penetrant dyes for neutron radiography (and perhaps also x-radiography). Enhancement of radiographic contrasts by use of LVCIs can reveal cracks, corrosion, and other defects that may be undetectable by ultrasonic inspection, that are hidden from direct optical inspection, and/or that are difficult or impossible to detect in radiographs made without dyes.

The figure presents two neutron radiographs of part of a frame made of 2219 aluminum alloy. The first radiograph, made before treating the frame with an LVCI, shows some corrosion and includes a faint dark line indicative of a weld crack at a corner. In the second radiograph, made after treating the frame with an LVCI, the weld crack is more clearly visible as a longer, thicker, bright line.

It has been conjectured that LVCIs may be useful as penetrant dyes for x-ray as well as for neutron radiography. Further research is needed to determine which formulations of LVCIs would be most suitable for dual use as corrosion inhibitors and penetrant dyes for radiography. For example, in formulating an LVCI for a particular application it might be possible to add a small amount of x-ray-attenuating material to enhance x-radiographic contrast.



A **Weld Crack Is More Clearly Visible** in a neutron radiograph made after treatment with an LVCI.

This work was done by Howard L. Novak and Phillip B. Hall of USBI Co. for **Marshall Space Flight Center**. *Further information is contained in a TSP (see page 1).*

This invention is owned by NASA, and a patent application has been filed. For further information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at (256) 544-5226 or sammy.nabors@msfc.nasa.gov. Refer to MFS-31562.

Transparent Metal-Salt-Filled Polymeric Radiation Shields

These shields offer advantages over ones made from lead foil or leaded glass.

Marshall Space Flight Center, Alabama

"COR-RA" (colorless atomic oxygen resistant — radiation shield) is the name of a transparent polymeric material filled with x-ray-absorbing salts of lead, bismuth, cesium, and thorium. COR-RA is suitable for use in shielding personnel against bremsstrahlung radiation from electron-beam welding and industrial and medical x-ray equipment. In comparison with lead-foil and leaded-glass shields that give equivalent protection against x-rays (see table), COR-RA shields are mechanically more durable.

COR-RA absorbs not only x-rays but also neutrons and γ rays without adverse effects on optical or mechanical performance. The formulation of COR-RA with the most favorable mechanical-durability and optical properties contains 22 weight percent of bismuth to absorb x-rays, plus 45 atomic percent hydrogen for shielding against neutrons.

	Lead	Leaded Glass	COR-RA
Thickness	0.3 mm	1.2 mm	4.5 mm
Areal Mass Density, g/cm^2	0.34	0.75	0.72
Mechanical Quality	Ductile	Brittle	Plastic
Optical Quality	Opaque	Transparent	Transparent
Mass Density	11	6.22	1.6
Use Temperature, °C	<300	<350	<200

The **Quantitative and Qualitative Parameters** in this table are those of three shields that give equivalent protection against ionizing radiation.

This work was done by David Edwards of **Marshall Space Flight Center** *and John Lennhoff and George Harris of Triton Systems, Inc. Further information is contained in a TSP (see page 1).*
MFS-31371