UOP Adsorbents

Preventing gas buildup in zinc-rich coatings

A Honeywell Company

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Minimize handling issues and extend shelf life

The use of zinc dust coatings has long been an attractive application for the prevention of corrosion, particularly ferrous substrates. However, severe storage problems can develop because of gas buildup in the zinc primer. The extreme reactivity of zinc dust with trace amounts of moisture produces hydrogen gas which causes pressure increases and reduces shelf life of the primers.

Classically, calcium oxide (Quicklime) has been used in attempts to prevent gassing in zinc dust coatings. Quicklime, a chemical adsorbent, reacts with the residual water present to yield a $Ca(OH)_2$, making it dangerous to handle and capable of saponifying any esters present in the organic portion of the formulation. The high heat of CaO with water and swelling of the CaO upon reaction makes it undesirable as a drying agent.

The use of UOP molecular sieves minimizes handling problems, lengthens storage life, and scavenges all trace moisture present, thus eliminating the cause of gassing before it can occur.

UOP molecular sieves are synthetic crystalline metal aluminosilicates belonging to a class of minerals knows as zeolites. The molecular sieve crystals, when dehydrated, provide a network of cavities which have a very high surface area for adsorbing water and are interconnected by channels having uniform pore openings. Molecular sieves are capable of adsorbing and isolating water within their crystal lattice, but are themselves inert in the presence of most compounds. These unique properties — strong adsorption forces, uniform pore size, and the very high surface area — make UOP molecular sieves ideal for isolating water from metal parts thus preventing the water from reacting with the metal.

Molecular sieve powders are successfully used to prevent gelation, erratic viscosity and other problems in adhesive, sealant, coating, paint, plastic, and rubber systems.

Physical and Chemical Properties

Chemical Composition*	
UOP MOLSIV™ 4A adsorbent	Na_{12} $(AlO_2)_{12}(SiO_2)_{12}$
Appearance	White powder
Bulk density	30 lb/ft^3
Particle Size	1-5 microns
Heat of adsorption (Max.)	1800 Btu/lb H_2O
Storage stability of powder	Good if normal precautions are taken to exclude moisture
Toxicity	Avoid breathing dust and prolonged or repeated skin contact. In case of contact with eyes, immediately flush with water for at least 15 minutes.

* Activated form, water of hydration has been removed

Formulation

To remove residual moisture from zinc primers, UOP MOLSIV 4A adsorbent powder is added in the proportion of 1% by weight (UOP MOLSIV 3A adsorbent may also be used) when suspected water concentrations are less than 0.3%. Proportionately higher amounts of molecular sieves are necessary for greater water concentrations. Our molecular sieves may be added at any time during the blending of the primer either by rapid stirring or in conjunction with addition of the zinc dust to to the vehicle.

Our UOP MOLSIV 4A adsorbent and silica gel were evaluated on the amine cured, zinc-rich epoxy primer formulation given in **Table 1**.

Table 1
Primer Formulation Used to Test the Scavenging Ability of Molecular Sieves and Silica Gel

Ingredients	Grams
Zinc dust	3000
ERL-2774[a]	687
Bentone® 38[b]	50
Xylene	31
Methyl isobutyl ketone	28
Ethanol	18
Butyl CELLOSOLVE	3.2
Catalyzed with amine	

a. CAS #85101-00-4
b. Elementis Specialties

Reagent materials were used with the water levels controlled to give either 0.1 or 0.2 Wt% water in the formulations tested. The desiccants were added to obtain a final desiccant concentration of 1 Wt% All samples were stored at a constant temperature of 140°F, with pressure readings taken at frequent intervals.

Proven superior performance

To individual control samples (containing 0.1% water), 1% silica gel and 1% UOP MOLSIV 4A adsorbent was added. As can be seen in **Figure 1**, the sample containing 1% silica gel developed a pressure of 21 psig in only one week while the sample containing UOP MOLSIV 4A adsorbent never developed a pressure greater than 2 psig.

Increasing the water content to 0.2% while holding the desiccant content at 1% showed the great superiority of UOP MOLSIV 4A adsorbent in comparison to silica gel. After two and a half days, the sample containing silica gel had to be discontinued because of excess pressure, 25 psig. **Figure 2** shows that the sample containing UOP MOLSIV 4A adsorbent, even after almost one month, never developed a pressure greater than 4 psig.

Figure 1
Gassing in Zinc-Rich Paints

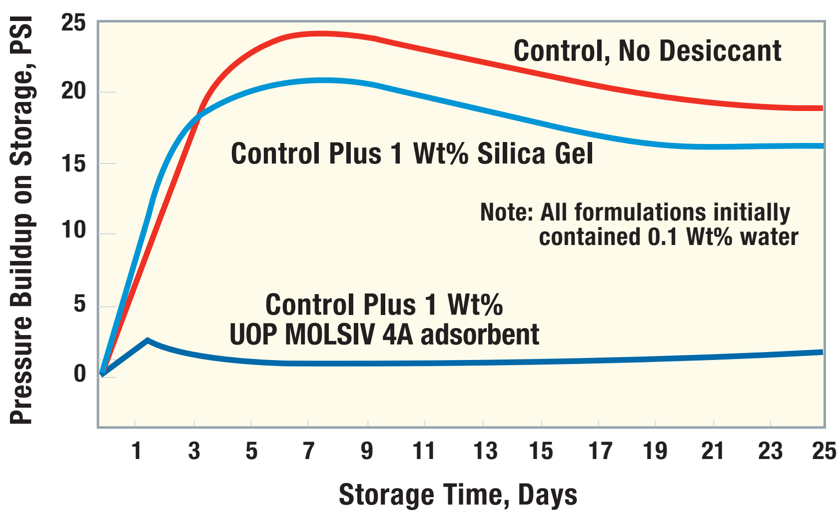
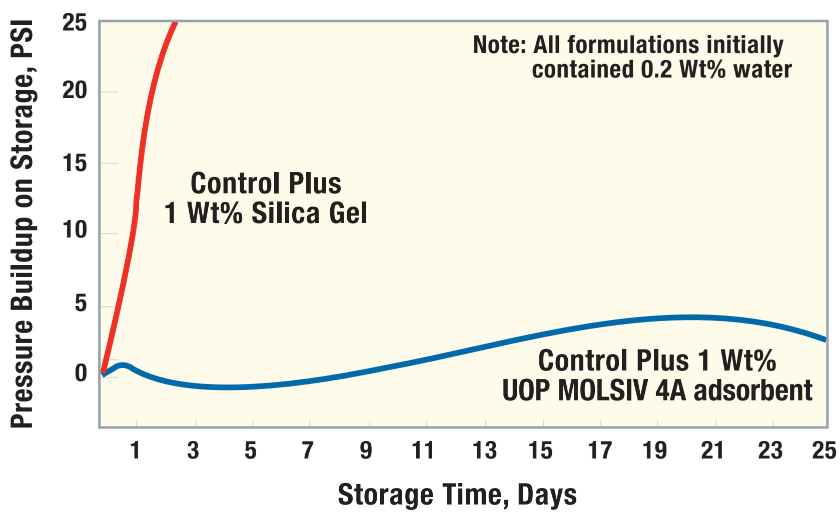
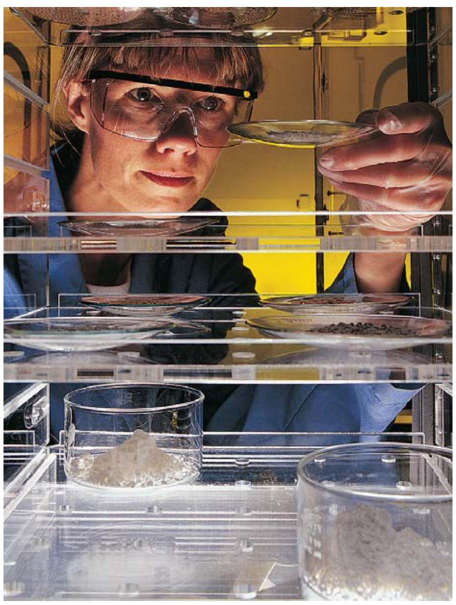


Figure 2
Gassing in Zinc-Rich Paints





Find out more

If you are interested in learning more about our UOP adsorbents please contact your UOP representative or visit us online at www.uop.com

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