Stress-Free Coatings… Made Possible by Solvents

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For OEMs and other coatings end-users, reducing costs, increasing production efficiencies, and driving product sales are critical to stay competitive. Choosing the right coating can help them achieve these goals. That, however, puts tremendous stress on the makers of coatings: with the increased selection of raw materials available for coatings and the complex environmental regulations governing the industry, formulating coatings seems ever more intricate and complicated. Given the tight competition dominating the coatings marketplace, coatings failures are simply unacceptable.

The right solvent selection can reduce coatings failures caused by formulation stress. In addition, coatings formulated with the right solvents offer end-users important performance benefits: reduced surface cracking and flaking, stronger adhesion, faster dry time, and durable, eye-catching finishes. This article discusses the formulation stresses that can cause coatings failures, and offers practical tips on managing them with solvents.

Remember your customers' needs first

This may seem like a simple point, but it is critical. When formulating coatings, remember that a coatings end-user, regardless of the industry, is looking for a coating that not only protects its products but also gives them appeal. Delivering a coating that offers good performance benefits, no stress problems, and a bright, durable finish will go a long way to build customer loyalty.

Identify the sources of coatings stress

Ninety percent of all coatings failures are the result of a stress-related problem. Cracking, flaking, and bubbling of the coating surface is both unsightly and damaging to the coated surface. Identifying the source of stress is critical to solving coatings stress quickly and efficiently. At Eastman, we examine coatings stress from five angles:

> ***Environmental stress***, caused when a coated surface is exposed to the elements such as moisture, cold, extreme heat, and salt;

Pigment stress, a corollary to environmental stress, caused when pigment particles bubble or agglomerated pigments form within a coating system, which become points of stress concentration that can lower the tear strength of a coating system;

Cure stress, bubbling, cracking and flaking that can occur as coatings dry;

Multiple-surface stress, cracks and flakes that occur by improper balance of coating-to-substrate tension and/or inter-coat surface tension; and,

Mechanical stress, results when improper design of the coating leads to film failure by rupturing or cracking once it's subjected to physical manipulation.

Control the evaporation rate

Coatings have to adhere to the substrate to protect it against adverse weather and other environmental conditions. Controlling the rate of solvent evaporation helps manage the flow characteristics of a coating's film to create a durable, resistant coating with a uniform film. Eastman's solvents are designed to give formulators tremendous latitude in coatings formulations. The slow evaporation rate of our MAK solvent , for example, creates a resistant, uniform film and an appealing high gloss in high solids topcoats.

Promote proper pigment wetting

Proper pigment wetting affects the gloss, gloss retention, corrosion resistance, leveling, and overall film integrity of the paint. Without it, vacuoles, air bubbles, and pigment agglomeration will surface, weakening the pigmented film and leading to compromised film integrity. Using a solvent, and particularly ones in the ester family like fast-methyl acetate; medium-n-propyl acetate; and slow-EEP, can help prevent this because they are effective at lowering the surface tension and viscosity of the binder thereby promoting pigment wetting. In addition ester solvents offer low odor, good solvency and are available in a range of boiling points, to satisfy the formulator's needs. These solvents offer coatings systems a number of important performance and aesthetic benefits: high yellowing resistance, high gloss, good drying and mechanical properties, high corrosion protection, and excellent weather resistance.

Take a layered approach

Maximize the adhesive and cohesive forces within coatings systems. Ensure that each coating has an equal, if not greater, tensile strength and rigidity than the layer above it. As a rule of thumb, the surface energy of the substrate must be higher than the surface tension of the liquid coating that is being applied in order for adhesion to occur. Good inter-coat adhesion occurs when the surface tension of each layer of coating decreases with each layer applied. Ketone solvents, like *Eastman* MPK, can be used to manage multi-surface stress, because they exhibit low surface tension, improving substrate wetting and promoting adhesion.

Consider surface-active solvents

Once a liquid coating has been applied to a substrate, it is cured in one of two ways: through a chemical reaction during the drying stage, or through the evaporation of solvents. Stress is introduced from the dimensional changes occurring within the coating as it is being anchored to the substrate, and can also result in bubbling, cracking or flaking. Surface-active solvents such as alcohols and glycol-ethers will readily migrate to the coating's surface, reducing tension and promoting improved substrate wetting and a cohesive film.

Reformulate with a longer cure window

To improve the durability and barrier performance of coatings, a formulator will often increase the cross-linking agent in a coating to promote a tighter film network. In so doing, coatings may show improved hardness. However, there is a trade-off. A tighter cross-links film can show a reduction in flexibility of the film leading to stress induced cracks, adhesion loss and a pathway for corrosion failure during physical manipulation and aging—the very problems that increasing the barrier performance was trying to resolve!

Reformulating the solvent system to promote a longer cure window can help ensure that the resin and cross-linker is given adequate time to complete the curing process resulting in a stronger coating bond, with good flow and leveling properties.

Ask your solvent supplier for help

Good solvent suppliers will work closely with their customers to ensure they have the best solution for each coating application. They are well versed in current coatings technologies, actively work on formulating innovations, and offer customers technical assistance on performance and regulatory requirements-- all of which can help their customers build their own customer loyalty, and maybe even enter new markets. Eastman, for example, recently launched www.PerformanceSolvents.com, a website designed to provide coatings formulators with formulation advice and up-to-date information on regulatory issues and raw materials. The website offers real-time information to help address formulating questions and compliments its extensive staff technical service representatives.

About Ranae Anderson

Anderson is a Senior Technical Service Representative for Eastman Chemical Company with nearly 10 years of experience working in formulating, material analysis, and quality control in the chemicals industry. In her current position, she is responsible for providing technical service, information and education to customers of Eastman's solvent products. She holds a MS in colloid, polymer and surface sciences from Carnegie Mellon University in Pittsburgh, Penn.

For more information

Contact Eastman's solvents team at 1 (800)-EASTMAN, at +1 423 229-4166 outside the United States or visit Eastman on the web at www.PerformanceSolvents.com or www.eastman.com/solvents