Advances in Anaerobics

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The major appliance industry is intensely competitive, with manufacturers moving aggressively to strengthen their competitive positions worldwide. To reduce costs and improve profitability, appliance engineers continually strive to develop innovative product designs and manufacturing efficiencies using new technologies, including adhesives.

The use of anaerobic adhesives has become increasingly popular in appliance assembly applications, as they provide a number of manufacturing benefits. Typically used to augment the seal or holding force of a mechanically joined appliance assembly, anaerobic adhesives serve as threadlockers, thread sealants, retaining materials, and flange sealants. When designed into an appliance assembly, these adhesives are used to reduce component inventories (thereby decreasing total manufacturing costs), enhance equipment reliability, and minimize aftermarket breakdown and associated warrantee problems.

By definition, anaerobic adhesives remain liquid until isolated from oxygen in the presence of metal ions, such as iron or copper. For example, when an anaerobic adhesive is sealed between a nut and a bolt on a threaded assembly, it rapidly “cures” or hardens to form a tough crosslinked plastic with tenacious adhesion to many metals. Though anaerobic applications differ widely, in most cases the adhesive provides high shear strength.

- When anaerobic adhesive products are used to lock threaded assemblies together, they prevent loosening and corrosion of the fastener, maintain proper clamping force, and offer controlled torque for removal of the assembly. Threadlocking adhesives can be found in almost any appliance where threaded fasteners are used; thread sealants are used in appliances with pipe fittings, such as dishwashers and washing machines.

- For rigid cylindrical assemblies, such as joining a bushing into a shaft housing, anaerobic adhesives known as retaining compounds enable manufacturers to bond parts that, at one time, could only be assembled using press fits or shrink fits. In appliance applications, retaining compounds are most commonly found in motor and pump assemblies.

- Anaerobic gasketing materials are widely used as formed-in-place gaskets that produce leakproof seals between mating flanges, preventing leakage of liquids or gasses. These materials can be found in motor and pump applications, as well as vacuum cleaners, stoves, ranges, microwave ovens, refrigerators, and other appliances where a seal must be created to block out moisture, gasses, fluids, or contaminants.

Anaerobic Advancements

In the past, a number of application environments have been too stressful for traditional anaerobic adhesives. New anaerobic adhesives products have recently been introduced to enhance the performance of this technology in severe environments.

The greatest challenges faced with traditional anaerobic adhesives have been: 1) promoting cure on a wide range of metallic and non-metallic substrates that may be contaminated with grease or oil, 2) long-term exposure to elevated temperatures greater than 300°F, and 3) long-term exposure to high levels of mechanical stress.

To ensure longer life of devices, many manufacturers are incorporating into their appliance designs special substrates that resist rust and corrosion. Such passive materials include Zinc dichromate/phosphate plated steel, magnesium, cadmium, stainless steel, aluminum, and thermoset plastics -- substrates that could once only be bonded by treating the materials with solvent based primers before applying the anaerobic adhesive. To solve this dilemma, new surface insensitive anaerobic formulations have been developed that bond passive substrates

without the use of environmentally hazardous solvent based primers, and to be forgiving of oil and grease contaminated surfaces, eliminating the need to clean parts before adhesive application.

New surface insensitive adhesives have been engineered to combine the curing properties of modified, solvent-free primers with anaerobic chemistry, creating a single component, room temperature stable adhesive technology that is efficient and easy to apply. These products are expected to improve the production output of appliance manufacturing and to cut costs by eliminating primer inventories, application processes, and associated cleaning of parts. Surface insensitive anaerobic formulations are excellent for dishwashers, clothes washers and driers, food processors, blenders, gardening power tools, and many others appliances that come into regular contact with gasses, fluids, or moisture.

Traditional threadlocking adhesives withstand limited temperatures (–55°F to 300°F) without failure. However, appliances such as cooking ranges or stoves, and any device with a motor assembly will easily generate temperatures in excess of this limit. By incorporating innovative new proprietary chemical technology, the latest anaerobic materials have been formulated to endure more heat, maintaining their integrity at temperatures up to 400°F. Such adhesives are excellent for clothes dryers, stoves, ovens, lawn and garden power equipment, and other high temperature appliance applications

Recent advancements in appliance engineering include new smaller, high performance motors and pumps that run at very high speeds, generating elevated temperatures and increased vibrational shock. While traditional high strength anaerobic adhesives can withstand some level of vibration, the combination of elevated operating temperatures and strong ongoing vibration typically prove to be too much for conventional anaerobics.

New toughened adhesive formulations have been engineered to provide better overall performance under extreme thermal and mechanical stress. Because these materials are tougher than traditional anaerobics, they are less impact sensitive and can withstand prolonged exposure to intense vibration, rotational, shear and tensile forces. These new toughened anaerobic adhesives are ideal for appliances that are being redesigned for longer life and improved performance, and could be readily used for retention of bearings, gears, pulleys, sleeves, bushings, and oil seals, as well as securing pins, keys, dowels and other cylindrical components found in electric motors and other rotating assemblies.

Adhesive formulators are continuously working on developing new high performance anaerobic products. The next generation of threadlockers, thread sealants, and retaining compounds will perform at significantly higher temperatures (up to 800°F) for extended periods. These materials will be ideal for manufacturing cooking ranges, ovens, and other appliances where high temperature extremes are encountered.

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