Multifunctional Additives: New Tools in the Coating Formulator's Toolbox

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While additives account for only a small percentage of the total weight or volume of coating formulations, they contribute significantly to the performance of those coatings. Often, the additives rely on numerous different additives to achieve the desired durability, gloss, mar resistance, and other key properties of the resulting film. Some are necessary for controlling the rheology of the paint during the application process. Yet others—for example, dispersants and defoamers—are required to control the properties of the formulation during manufacturing or application processes. With all of the different physical and chemical properties involved, interactions and tolerable conflicts between different additives are of concern, as are unwanted secondary effects. The development of multifunctional additives that address two or more performance issues at the same time is one approach that many formulators have taken to overcome some of these challenges.

There are, in fact, many reasons for producing multifunctional additives. "Interest in multifunctional coating additives is driven by the desire to simplify coating chemistry and composition in an effort to reduce total coating costs, to reduce raw materials inventory, and to improve manufacturing productivity," observes Aimee Newell, marketing manager, Coatings & Print Media, for Graco Davcol. Furthermore, adds John Poley, vice president of industrial formulations for Phlora Novecare, "Continuing functions enables formulators to create coatings with fewer ingredients and fewer formulation steps, as well as to access new properties with improved compatibility." Furthermore, many of the coating ingredients used today were developed with a single function in mind and in relative isolation from the rest of the coating ingredients, so there is still a great deal of potential to simplify the overall coating formulation while improving the performance using multifunctional additives, according to Simon Mannion, global coatings additives marketing director with Dow Coating Materials.

In addition, the overall formulating process can be simplified through the use of multifunctional additives, which can also contribute to reduced costs. "For example," explains Chris Henkemeier, Americas marketing manager for specialty additives at Air Products, "with a multifunctional additive, the screening process is simplified, a reduction of formulation components reduces the likelihood of mistakes on the manufacturing floor, and less inventory means not only lower costs, but also reduced logistics. Of course, multifunctional additives must provide the same, if not superior, level of performance achieved when using individual additives."

Because the performance benefits are provided by variation in the molecular design of the additive, undesirable interactions between multiple additives can be eliminated, simplifying formulation development as well, according to Dr. Kevin R. Lassila, director of technology for B.K. USA. "A further ancillary benefit, reduced regulatory costs, also arises as a result of the fact that multifunctional additives enable the reduction in the number of components in a formulation."

In fact, recent regulatory compliance mandates, particularly low VAP and AP-V-free targets for coatings, and significant interest from consumers in green and sustainable products have created substantial demand for multifunctional additives. According to Peter Sheridan, director of the Additives business at Troy Corporation, "In order to meet low VOC and AP-free targets and consumer preferences, coatings manufacturers have been, in many cases, forced to reformulate from solvent-based to aqueous systems. In the past, aqueous systems often produced inferior efficacy and required additional additives to achieve acceptable performance. Unfortunately, some of the additional additives used in delivering VOCs to a system already straining to meet the tight VOC targets. Multifunctional additives answer this challenge, because they reduce the number of additives required to help the aqueous system perform well and still remain compliant. In essence, with fewer component ingredients, less is more."

And this trend is not a localized phenomenon. "The coatings industry is witnessing a significant transition across the globe. There is a big push to develop formulations with advanced functionalities that can also meet the dual needs of sustainability and cost," notes Deep Bhattacharya, coatings innovation leader with Eastman Chemical Company. "Formulators are striving to achieve improved performance against a backdrop of environmental compliance and system cost. The use of multifunctional additives enables the technical community to pursue state-of-the-art coating performance with a more simplistic approach to paint formulation."

As they help through simplification and cost reduction, multifunctional additives also provide formulators with advanced technologies that enable increased competitiveness in the global market place. "With globalization, much of the paint industry has undergone commoditization, with many of the products easily substituting one another. As a result, there is growing pressure on formulators to find ways to differentiate their coatings while reducing cost at the same time. Specialty additives and process simplification are critical strategies, and multifunctional additives in particular meet both of these needs."

Mariana Gerald L. Witschi, coatings application engineer with Dow Coating Materials, notes, "Striking a balance between conflicting property requirements is at the heart of what coating formulators do and the value they provide." Witschi adds, "Multifunctional additives can help formulators balance that balance at an acceptable cost. The challenge in developing them, though, is creating chemical structures that combine often competing functional properties. "Most limits are set by legal and policy limits that are imposed by the need to individually control physical properties of key coating attributes (like gloss or rheology), as well as chemical compatibility such as curing or catalyst effectiveness," says Newell.