

OUTLOOK FOR AUTOMOTIVE PLASTICS COATINGS

An Analysis of the North American Market

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Executive Summary

Coatings for plastic automotive components have historically shown strong growth of 7-10% (per vehicle), driven by the strong growth rate of plastics usage. The authors of this paper have analyzed the North American automotive market and have concluded that the coatings growth for plastics will show marked slowing with growth of 1.5-1.9%/yr per vehicle over the next five years due to:

- Slowing of the automotive plastics grow rate
- Improved plastics technology that precludes the need for coatings, primarily molded-in color for interior components

Coatings technology trends will cause significant changes such as:

- Increased use of waterborne products, both one and two component, driven by environmental regulations
- Increased adhesion challenges as thermoplastic polyolefins (TPOs) become the prevalent plastic of choice
- Drive toward molded-in color
- Enhanced performance requirements for chemical resistance and esthetics (appearance, feel)



Introduction/Methodology

ChemQuest Group, Inc., is a management consulting firm that specializes in the Coatings, Adhesives, Sealants, and Automotive Industries with offices throughout the United States and Europe. ChemQuest has analyzed these industries continuously since 1975, mainly through proprietary (single client) studies as well as multi-client industry studies. This paper was developed from on-going research into the use, trends and dynamics of the automotive coatings industry.

The methodology for this paper was to simultaneously research and analyze the growth rate of plastics usage per vehicle as well as coatings usage per vehicle. Furthermore, the trends affecting each growth rate were analyzed to quantitatively determine if each trend would increase or decrease plastic coating usage. The two analyses were then brought together to assess the overall impact on coatings for plastics.



Analysis of the Plastic Substrate Market

Slowing Usage of Plastics for Automotive Body Applications in North America

The first analysis was conducted on the plastic substrates to understand the growth of available surface area for coating as well as changes in the substrate that would impact coatings technology.

The use of plastics on a weight per vehicle (WPV) basis during the 1990's has shown slow to flat growth after phenomenal growth in the 1970's and 1980's. The average WPV usage has been essentially flat for three model years, at a time when the overall vehicle weight has shown a slight increase. Importantly, the relative use of plastics has actually slipped slightly. This slowing of growth has been attributed to several factors:

- Decreased design and engineering emphasis on weight savings
- Fewer “low hanging fruit” opportunities substitution of metals
- Increasing relative cost of plastics versus metals
- Substitution (actually cannibalization) of high-density plastics by low-density plastics

Less emphasis on weight savings

The average weight for a North American vehicle has risen for 7 model years in a row from approximately 3,100 lbs. in the early 1990's to approximately 3,300 lbs. in 1998. However, the WPV usage of plastics has been approximately 250 lbs. for the last four years – in essence losing relative ground to other materials. Both of these statistics can be interpreted as an underlying trend of less emphasis by the automakers on vehicle weight during the 1990s.

The cause of this trend is suggested to be the lessening of automaker focus on fuel economy. Until the recent surge in light trucks and sport utility vehicles (SUVs), the North American makers have



largely met the Corporate Average Fuel Economy (CAFE) regulations set in 1975. Design engineers switched their focus to cost reduction, safety and recycle issues. These design priorities set the criteria driving material choice and usage under which material decisions are made today.

Because of the continued strong demand for light trucks/SUVs and the impact this demand has on automakers' ability to comply with CAFE requirements, ChemQuest forecasts that weight reduction will increase in importance to designers and engineers over the next five years. However, the importance will not be to the levels seen in the 1980s, and will probably be overshadowed by other priorities such as cost and recyclability. There should be a slight uptick in WPV usage of plastics as a result of this trend.

Fewer "low hanging fruit" opportunities for plastics

The less design/performance challenging components of the automobile were converted to plastic many years ago. Substitution of metals by plastics has slowed in recent model years as engineers struggled with performance, crashworthiness and cost issues. At the same time, the metal industries have made great strides in the cost/performance balance of their materials versus plastics, and have stepped up the marketing of their efforts. The best example is the retrenching seen by the steel industry to address the threat of aluminum and plastics as substitutes for steel. Through the American Iron and Steel Institute (AISI), the steel industry has shown a united front in such initiatives as the UltraLight Steel Auto Body (ULSAB) project. Such a coordinated effort will slow the inroad of plastics, especially in exterior body and chassis components.

ChemQuest forecasts that plastics will grow in areas where plastic offers benefits other than cost and weight reduction, such as fuel tanks (extra capacity and safety) and engine intake manifolds (improved engine performance). These applications are more technically challenging and will be harder won in the next five years. The effect of this trend will be a slower growth of plastics.

Increasing relative cost versus metals

ChemQuest forecasts that plastics will continue to have a raw material cost disadvantage versus steel for the next five years. Furthermore, design efforts such as the ULSAB will give steel



additional advantages in cost for body applications. This will lead to a widening gap in the advantage of steel in those body applications where raw material cost is a major cost component. This trend will continue to slow the growth of plastics.

Cannibalization of high-density plastics by low-density plastics

While the substitution of steel by plastics has slowed, there has been much substitution among the various generic plastics. In general, the strongest trend has been from high-density materials such as RIM to low-density materials such as TPO. This “cannibalization” is being driven by lower material cost – both \$/lb. as well as less material per component. While this trend has not significantly altered the *volume* of plastics per vehicle, it has had an effect on the WPV usage, slowing the growth of this metric.

ChemQuest forecasts this trend to continue for the next five years with the effect of slowing the WPV growth of plastics, but having little effect on the volume or surface area of plastics used.

ChemQuest forecasts that the combined effect of these trends will keep overall plastics WPV growth to <1%/yr. through 2004.

Trends of Interior Plastics will sharply alter Coatings Usage

The primary determinant of interior coatings growth will not be the growth of plastic substrate surface area, but rather the cost/performance gains from not using coatings in favor of molded-in color. The penetration of plastics as a substitution of metals on the interior appears to be complete. There should be a slight increase in plastic usage and surface area due to the increasing size of the average vehicle. However, from a coatings standpoint, the picture is not rosy, and the trends affecting interior plastics will most likely cause a decrease in the per-vehicle usage of coatings for interior applications. Those trends are:

- ❑ Increased usage of TPO
- ❑ More molded-in color
- ❑ Component integration and fewer materials of construction



There is interdependency among these trends ultimately driven by the design engineers need for lower component cost, more efficient assembly and to a lesser extent, enhanced recyclability.

Increased usage of TPO

Many hard trim applications are moving toward TPO as the material of choice for cost reasons. In addition to penetrating the hard trim components (at the expense of ABS), TPO is moving into instrument panel (IP) skins replacing vinyl, and into air bag doors/covers replacing RIM and thermoplastic polyester.

More molded-in color

Possibly the largest threat to interior coatings usage is molded-in color. Molded-in color has long been an attribute touted by the plastics producers as an advantage over metals. Performance issues, specifically fade resistance, as well as color and gloss consistency have hampered the use of molded-in color. However, it appears that the molded-in color trend is about to pick up pace.

The performance issues of molded-in color have largely been addressed. Concerns regarding fade resistance and chemical resistance have decreased as TPO and polypropylene have increased in usage. In addition, the prevalence of TPO has resolved many color match issues by converging the materials choice to one generic material. Gloss and “feel” are still open issues for molded-in color, and solution could come in the form of a clear coating. By the 2004 model year, molded-in color should dominate over the use of coatings.

Fewer components and materials of construction

Recyclability concerns are driving further consolidation of components and materials. This will accelerate the decline of coatings usage due to difficulties in separating the coating from the plastic. The trend toward fewer components and modular construction will drive fewer material choices further easing color match concerns as well as decreasing costs and improving recyclability.

The combined effect of these trends is stagnant growth of plastics WPV usage for interior applications. Any growth from larger vehicle product mix will more than likely be offset by the use of



lower density plastics. Surface area should increase slightly as the vehicle mix moves to larger vehicles.

The net effect of these trends will be sharp decline in the usage of interior coatings.

Exterior Plastics will be the Growth Engine for Plastic Coatings

The primary determinant of exterior plastic coatings growth will continue to be the rate at which plastics displace metals in exterior applications. The exterior will continue to show slow substitution of metals by plastics with per vehicle usage growing 2-3%/yr. The growth rate will be a function of three underlying, yet competing, trends:

- Strong WPV growth of plastics in the growing light truck/SUV segment
- Cannibalization of high density plastics by low density plastics
- Continued advantages for steel in vertical panels

Strong growth in the light truck/SUV segment

Light truck vehicles will show the strongest growth for exterior plastics WPV as styling trends drive toward integrated bumper systems and grills. In addition, there will be continued interest in major components being converted to SMC as automakers struggle with meeting CAFE and possibly a raising of the CAFE requirements of light trucks early next decade. There will not only be an increase in WPV usage of plastics, but also the available surface area to be coated. This should be one of the strongest areas for plastic coatings growth for the next five years.

Cannibalization of high density plastics (RIM) by low density (TPO)

TPO has made particularly strong inroads as a replacement for RIM in the bumper fascia and cover applications. Lower costs, lower weight and improved recyclability drive cannibalization. The net effect has been to lower WPV usage due to the density differences,



but about parity on the available surface area for paint. However, TPO has been more challenging for paint adhesion, and this will be an on-going trend affecting coatings technology for the next 3-5 years.

Strong advantages for steel in vertical panels

Steel continues to be used in 99% of all body panels due to cost advantages and crashworthiness. ChemQuest forecasts this trend to continue for the next five years, and probably increase slightly as the coordinated efforts of the steel industry begin to have an impact on the plastics and aluminum industries' efforts. The net effect will be very little growth in plastics in vertical panels and the subsequent impact on coatings usage.

The conclusion of the plastics analysis is that the trends should cause the coatings growth rate to slow into the range of 1-2%/yr./vehicile through the 2004 model year.



Analysis of the Overall Plastic Coatings Market

Growth Trends of Coatings for Plastics - North America

The second analysis was to understand the overall North American plastic coatings market and the trends in automotive as well as non-automotive uses.

In 1998 the volume of coatings sold for applications on plastics was just over 20 million gallons and \$680 million. (This amount does not include vinyl floor coatings or hot stamping foil applications.) By 2003 the volume is expected to grow to 22.5 million gallons and \$800 million. (Figure I) The average growth rate has recently decreased from a rigorous 7-8% in past years to about 3.3% per year, or a little over GNP, and is expected to slow even more long term. Cost pressures on OEMs, as well as technical advances in the plastics industry, have fostered the elimination of standard pigmented coatings in many applications, particularly automotive interiors, and this trend is expected to continue. Growth in exterior automotive applications will be stronger than interior due to styling preferences and aesthetic (color match) requirements. Specialty finishes such as soft-feel, woodgrain, and EMI shielding coatings are continuing to grow at rates that exceed the rest of the market.

Coatings for automotive plastics, which account for an estimated 70% of the total volume and just over 70% of the revenue, dominate the market. The rest of the market (excluding coatings for vinyl floors and hot stamp foils) is relatively small and very fragmented. The next largest market sector, business machines, is so much smaller than automotive that its fluctuations have relatively little affect on the total plastic coatings market. Therefore it makes sense to concentrate the paper on coatings for automotive plastics.



Total Plastic Coatings - North America

Growth Trends

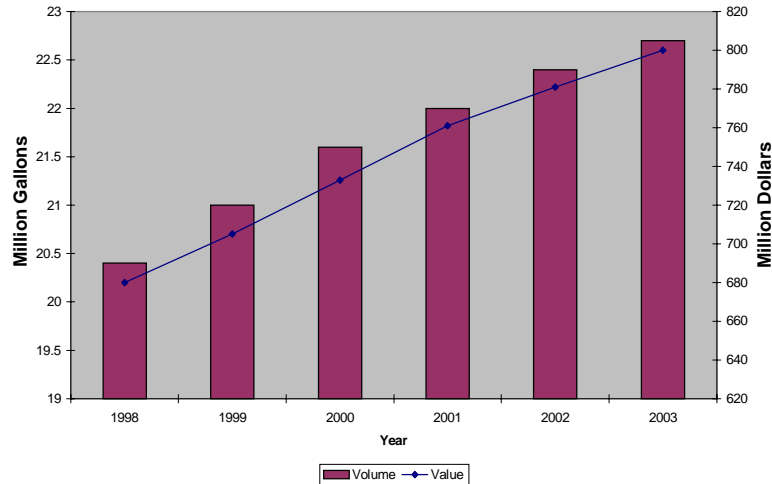


FIGURE I

Factors Affecting Plastic Coatings Volume Growth

During the next five years volume growth in plastic coatings for automotive applications is expected to slow to 1.5-1.9% per year on a per vehicle basis. Therefore, the growth in the overall market will be heavily dependent on the growth of end use markets. Factors that have a measurable effect on the use of coatings are related to changes in the types and amounts of plastic available for coating and coating application techniques, including:

- Increased substitution of thermoplastic for thermoset plastics
- Increased usage of molded-in-color
- Growth in sales of light duty trucks
- Coatings application improvements

Increased Substitution of Thermoplastic for Thermoset Plastic/ Increased Usage of Molded-in-Color

Thermoplastic substrates exhibit improved ultraviolet light resistance and chemical resistance over thermoset plastics like ABS, vinyl and many composites. The total cost of painting a part is



estimated to be up to 60% of the total cost of the finished part. This provides great incentive to eliminate the need for painting.

Though these plastics lend themselves well to molded-in-color, the difficulty in adhesion to these substrates, added to the aesthetic requirements of uniform surface appearance, gloss and soft-feel, provides opportunities for new primers and specialty coatings. However, as plastic polymers are improved to comply with gloss specifications and aesthetic requirements fewer coatings will be needed. This is not expected to have a large impact in the next five years but will be one of several factors causing the leveling off of plastic coatings growth early in the 2000's.

Coatings Application Improvements

Improvements in spray equipment and the advent of improved conductive primers for electrostatic spray application as well as the increasing popularity of in-mold coating have reduced the amount waste generated in the coating of plastic parts. This will continue to temper the growth of coatings volume for plastic substrates.

Factors Affecting Coatings Revenue Growth

The factors positively affecting plastic coatings revenue are primarily related to technology shifts and changes in requirements for performance and aesthetics which provide entry for higher priced coatings. Factors negatively affecting revenue are related to the competitive environment and market dynamics:

- ❑ Trend toward VOC and HAPS compliant coatings
- ❑ Trend toward egg-like styling in passenger cars
- ❑ Increased performance requirements
- ❑ Increase in molded-in-color
- ❑ OEM overcapacity and consolidation

Trend toward VOC and HAPS Compliant Coatings

Government regulations and legislation over the past ten years has forced the usage of higher priced technologies such as waterbased and high solids, which can cost over twice the price of low solids solvent based systems on a per pound basis. This trend will continue with tougher regulations anticipated in the early 21st Century.



Trend toward Egg-like Styling in Passenger Cars/Increase in Performance Requirements

As the push to modular manufacturing and like-styling of cars continues automotive companies will look for ways other than body style to differentiate their product. Also as the automotive companies strive to build vehicles that maintain their appearance and performance for 10 years or longer, the performance requirements of paint and coatings systems also grow. In the interior of the vehicle new specifications calling for insect repellent, suntan lotion, and hot fat resistance have opened the door for higher performance, slightly higher cost coatings. The growth in soft-feel and other special-effects coatings like woodgrain finishes, added to the change in performance requirements, has given rise to two part coatings, both waterborne and solventborne, and one-part polyurethane systems that will meet the aesthetic and rigorous performance requirements for interior automotive coatings. These systems are considerably higher priced than the solvent borne systems used in past years, like PVC, but lower in price than laminations. It should be noted, however, that like all other coatings these are under constant price pressure from the automotive companies and that products are under development that will provide a lower price/performance ratio.

In other market sectors, such as business machine and sports equipment, the additional value of special coatings like EMI shielding and urethane-containing coatings, respectively, provide an additional boost to coatings revenue.

OEM Overcapacity and Consolidation

During the last few years considerable consolidation has taken place at the automotive OEM level and today there is 30% overcapacity in automotive production. The increase in size of the automotive companies has increased their buying power for parts and coatings in a market that was already very competitive. The pressure to reduce costs transfers down to coatings suppliers who are forced to lower prices or lose business. To reverse the trend to lower pricing for coatings suppliers must look closely to find ways to provide more value to the OEM. Another revenue challenge is the advent of molded-in-color, which has eliminated a portion of the higher priced pigmented coatings in low-end and sports utility vehicles that have enjoyed historical growth.



Technology Trends

Anticipation of stricter regulations and legislation in the 21st century involving VOC and HAPS emissions has spurred the growth of compliant technologies. ChemQuest estimates that the average annual growth rate for waterborne technology in the automotive market to be near 6% with 2-part waterborne systems growing at around 9% during the next several years. UV curable technology will also grow at a fast rate of at least 9% per year but the growth is from a very small base. The growth in these technologies will be at the expense of low solids solvent borne systems, which will decrease in use. Powder coatings are considered an emerging technology in the plastic coatings market due to the temperature resistance limitations of current plastics. Advances by both plastic manufacturers in developing more temperature resistant plastic polymers, as well as recent technological developments by powder coatings suppliers to lower the coatings temperature, have fostered speculation that powder has future potential.

The major drivers of technology shifts have historically been related primarily to government regulations and these will continue. However, recent changes in substrates used, such as the switch from metal to plastic and from TPU, vinyl, and ABS to TPO and PP, have presented new challenges in the form of adhesion parameters and aesthetics, which could not be met by past coatings systems. Technological advances by suppliers to the coatings industry and application improvements have provided new avenues to meet market and regulatory requirements. Coatings cost continues as a primary driver and limitation for technological advancement efforts. Total applied cost/performance ratios must continue to be in line with market requirements.



SUMMARY

As we move into the 21st Century the market for coatings on plastics will be in the midst of change. ChemQuest forecasts that the overall plastic coatings volume growth per vehicle will track slightly faster than plastics growth at 1.5-1.9% per year. The usage per vehicle of coatings on interior components will decline moderately from past levels due to cost pressure from OEMs and the resulting trend toward molded-in-color on instrument panels and trim parts, especially in low end models and light duty trucks. However, growth of specialty finishes such as soft-feel, will continue. Due to styling preference for color matching the fascia to the vehicle body the exterior usage per vehicle of coatings will exhibit modest growth. Environmental pressure will continue to favor compliant technologies, such as waterborne, which will significantly outpace the growth in use of solventborne coatings. As TPO and PP continue to replace other plastics and metal, coatings to meet the challenge of adhesion to these substrates will grow much faster than coatings for other substrates.



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