General Magnaplate Corp.

CASE STUDY

Smart Coatings Solutions

New Materials and Design Concepts Used in Black & Decker's New ProFinish Steam Iron

By Corey Wesnitzer, General Magnaplate Corp.

What can you do to improve a "simple" electrical appliance that was first patented 115 years ago, is in practically every American home, and which most users already feel gives good service and value? That was the problem that faced the product designers at Black & Decker a few years back when management decided to move aggressively to regain its share of the upper tier of the electric iron market.

The electric iron has been around so long and is so ubiquitous (11 million are sold each year in the U.S.) that many users never give it a second thought. Irons just "are." Yet, when one considers that the modern steam iron is a hand-held device whose temperature can reach 400° F and in which water and electricity are always in close proximity, the fact that it is used safely by people of all ages and levels of education casts a different light on the subject.

Before the company spent its first dollar on design or capital investment for the new product, it determined to learn as much as it could about how irons are actually used. It invested a half million dollars interviewing more than 2,000 consumer in a vast market segmentation study. This revealed that one of the three user groups in the study - those identified as "appearance driven ironers" - made up only 20% of the market but accounted for 40% of all ironing "tonnage." To them, ironing is an important part of the laundry process. Obviously, these people (largely women) spend a great deal of time at the ironing board and have high standards for the look of the finished product. They are, therefore, the natural purchasers of a more efficient, easier-to-use iron and are the market segment targeted by Black & Decker for its premium product.

In the light of the survey results, Black & Decker's design engineers completely rethought the concept of an iron, attempting

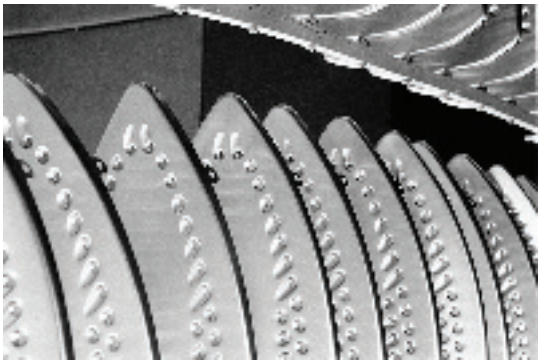
to optimize each of its components. Innovative thinking and the availability of new materials enabled them to make significant changes in both structure and design, thereby making the task of ironing clothes faster and more pleasant while the ironed clothes had a neater, more professional look than ever before.

Glide, Steam, and Comfort

With this end-user focus in its thinking, B&D identified three major "feature bundles" which the appearance-driven ironer said she wanted in her appliance - (1) glide, (2) steam, and (3) comfort. These caused it to concentrate on (1) the soleplate, (2) the steamer, and (3) the handle. Its consumer research revealed that such ironers wanted long-lasting soleplates that glide quickly and smoothly across the clothing without dragging or sticking , especially with starched fabrics. They want irons that produce "buckets of steam." And they want handles that are comfortable to hold and easy to maneuver in their long ironing sessions. It took two years, but eventually, the totality of the changes they effected in all three categories resulted in the revolutionary ProFinish[1] design. And arguably the most difficult problem to solve, the improved soleplate, turned into one of the ProFinish's most important assets.

The Soleplate

In re-inventing the steam iron, B&D reviewed all currently used soleplate designs and materials - anodized aluminum, titanium alloy, stainless steel, porcelain, satin aluminum, polished aluminum, and Silverstone[2] coated metal . All had some positive virtues but they also presented unwelcome tradeoffs between



great glideability and non-sticking qualities. No one material answered all the heavy-user's requirements. For example, while stainless steel has superior corrosion resistance and glides well on cotton at high temperatures, its non-stick starch resistance qualities were only fair. Silverstone also has excellent corrosion resistance and non-stick qualities but its gliding characteristics on cotton at high temperatures are poor. Besides, Silverstone coatings are only coatings - just thin layers of material which can peel off, abrade, or be scratched by buttons and zippers.

Moreover, for marketing leverage, B&D felt it could not settle for a "me too" soleplate. It wanted one which would be unique and offer sustainable competitive advantage over the years. And because some users prefer black soleplates while others prefer a stainless steel looking finish because of that product's great glide qualities, B&D felt it had to offer users a choice. The new iron's soleplate must be capable of being finished either way.

The design engineers at B&D investigated a number of possibilities and finally settled on working with General Magnaplate Corporation to produce a non-traditional soleplate material that produces a great non-stick, glideable surface for its heavy-user

market segment. They chose Magnaplate because of its extensive experience in producing enhanced metal surfaces for a wide variety of demanding applications. Developed to meet the harsh conditions of outer space, its "synergistic" coatings have been specified by NASA for use on hundreds of parts of every mission since the first space monkey was lifted off at Cape Canaveral.

From the beginning, this was a true case of "two-way," concurrent engineering. Magnaplate assigned a Project Manager, and her job was to work closely with Stephen Hall, Manager of Advanced Manufacturing Planning at Black & Decker. They freely exchanged information and technology. Working as a team, they found the best solution in the shortest time.

After several trial runs in which Magnaplate coated some cast aluminum soleplates with one of its many proprietary products, the consensus was reached that there didn't appear to be any way to coat the bottom of the soleplate in a cost effective manner. But the team persisted. Black & Decker came back to Magnaplate with a 17 point specification list including such items as smoothness, glide (under a variety of conditions), wear, UV-, stain-, corrosion-, and scratch-resistance, and even such hurdles as a temperature shock test in which coated soleplates were to be subjected to alternate heat and water quench.

Numerous versions of Magnaplate's "next generation" non-stick coating were tested until one was developed which met all 17 specifications for the black (U.S. market) soleplate. The product was designated Magnaglide NS^3 ("NS" for non-stick).
For the European market, preferring the highly polished look of stainless steel, the Project Manager directed the development of a special coating which it calls Magnaglide INOX^3 (for "Inoxidable" - Spanish for corrosion resistant). This enabled Magnaplate to create an ideal surface - smooth and slippery, with an amorphous, non-crystalline structure that meets both performance and appearance specifications. As she points out, the new surface is not just a coating over the base metal. Instead, Magnaglide NS and agnaglide INOX become integral parts of the existing aluminum substrates, locked and sealed so that they cannot be peeled, scraped, or rubbed off by a button or zipper.

Solving the Production Bottleneck

But they were not home free yet. Although the enhanced surfaces of the aluminum soleplate met all the performance requirements, the problem of high application costs still threatened to derail the project. One of the major expenses was the physical handling of the soleplates during racking and production. Another was the complicated masking requirements during the coating process. Shipping, storing, and handling expense compounded the situation.

In one innovative stroke, Hall solved these problems by re-designing the soleplate with a separate wrap component which could be handled and coated with ease, rather than working with the entire soleplate. Only after enhancement by Magnaplate would the wrap be affixed to the soleplate of the iron.
The final step was finding an aluminum alloy which would serve as a suitable substrate for both types of Magnaglide, eliminating the need to manufacture two wraps from two different materials. Eventually, Hall identified an alloy that could meet the performance

Smart Coatings Solutions

specifications and, with the Project Manager's help, found it to be compatible with both Magnaglide NS and Magnaglide INOX coatings.

Success

The Magnaglide enhancements on the ProFinish iron meets all B&D requirements. The characteristics include:

- Good glideability, Magnaglide NS is much slicker than Silverstone and Magnaglide INOX has the slickest non-stick coating with the easiest glide available on any iron from any manufacturer.
- Durable and scratch resistant
- Good wear resistance
- Excellent starch release properties
- Stain resistance
- Corrosion resistance
- Good thermal transfer
- Does not promote aluminum blistering (outgassing)
- Can be produced with black or bright chrome appearance
- Does not discolor from the heat
- Economic

In tests against all competitive finishes - Silverstone, anodized aluminum, stainless steel, etc. - the Magnaglide INOX soleplates proved superior on every count. Initial consumer reaction to the new ProFinish irons, as well as orders from such retailers as Walmart and Sears, have also been extremely positive. Black & Decker believes that General Magnaplate's Magnaglide surface enhancements deserve much of the credit.

1 ProFinish is a trademark of Black & Decker
2 Silverstone is a registered trademarks of DuPont
3 Magnaglide NS and Magnaglide INOX are registered trademarks of General Magnaplate Corporation