

Self-Assembly of Polymers and Nanoparticles in Personal Care Products

M.C. Berg, N.A. Suddaby and D. Soane

Soane Labs, LLC

35 Spinelli Place, Cambridge, MA 02138 USA mcberg@soanelabs.com

ABSTRACT

Soane Labs develops and applies nanotechnology and advanced polymer chemistry to the personal care industry through novel colorants and high-affinity polymers. By controlling the spontaneous self-assembly of polymers and nanoparticles at interfaces, the color, look, and feel of skin or hair can be modified. Furthermore, by modifying the surface using self-assembly of polymers, safe and environmentally friendly materials can be used with less toxicity than many materials currently used in personal care products. For example, many of today's commercial coloring products involve reactive precursor blends, which cause staining and other undesirable effects. In contrast, Soane Labs' hybrid pigments can impart both desired physical attributes and enhanced color. The combination of hybrid pigments and self-assembled polymers have been found to produce both hair and skin cosmetics with unique properties. Soane Labs has been successful in developing many hair care treatments using this area of nanotechnology including a system for advanced hair hold, easy-to-apply hair color, and UV-blocking/conditioning agents. Such nanotechnology products can lead to better product performance, high safety for consumers, and better economics for manufacturers.

Keywords: cosmetics, colorants, personal care, self-assembly, hair care

1 NOVEL EFFECTS PIGMENTS

Nacreous pigments are often composed of layered metal oxides that interfere with reflected light to produce a subtle iridescent color. These shimmering particles then have to be mixed with other dyes or pigments to produce a brilliant color in a coating or film. Soane Labs has developed a technology to attach colorants to nacreous pigments in a thin enough layer to sustain the shimmering color, yet thick enough to produce a brilliant scattering color. By providing these effects in one single pigment, many disadvantages to small molecule dyes such as bleeding or migration can be avoided and unique color effects can be produced. Figure 1 shows samples of these novel effects pigments over a range of color dispersed in a lacquer.



Figure 1. Novel effects pigments in lacquer.

2 HAIR COLOR

Traditional hair color treatments often involve harsh chemistry such as peroxides and oxidative couplers that can leave the hair damaged after treatment. The hair color treatment developed by Soane Labs does not chemically modify the hair yet is substantive to friction and shampoo washing after application. The treatment is a nanostructured material with a high affinity for the hair surface. These products can potentially benefit consumers both in the salon and in home applications. Figure 2 provides pictures of (a) a control sample of blonde hair and (b) blonde hair dyed black. A range of colors is being developed for both light-to-dark and dark-to-light transitions.



Figure 2. Images of (a) control blonde hair and (b) blonde hair dyed black.

3 HAIR STYLING

Hair styling products are particularly susceptible to humid conditions or other forms of moisture. In addition, many commercial products leave a stiff and/or tacky feel. Our unique hair styling polymeric system holds the desired hair shape under extreme humidity conditions and will withstand limited water submersion. It also has a softening agent built into the polymeric system to leave the hair with a desirable soft texture. Figure 3 depicts hair after 24 hours in 95% humidity conditions with various amount of styling polymer.



Figure 3. Hair samples after 24 hours in 95% humidity conditions.

4 CONDITIONER

Soane Labs has developed a conditioning polymer designed to have a high affinity for hair and impart a soft feel. Due to its high affinity, the polymer can withstand water and oil residues to leave a soft feel for a longer time compared to many conditioning polymers on the market. In addition, UV blockers have been successfully incorporated into the polymer synthesis to potentially block UV radiation from damaging the hair. In addition to softening and UV protection, the polymer can act as a base material for adding a variety of functionalities due to its attraction to the surface of hair.

5 CONCLUSIONS

Soane Labs has developed multiple active materials for use in the cosmetic industry. Many of these materials provide unique properties that can differentiate products from the competition. The underlying technology behind the Soane Labs products is self-assembly of polymers or polymer/nanoparticle systems onto surfaces.