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Versatile film technology for creating second skin wear

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Introduction:

The need for a novel film technology that provides the trade-off between long wear/transfer resistance comfort wear and easy application has been an emerging topic in the cosmetic industry. Our second skin technology is a single step emulsion that forms a film upon evaporation and provides high versatility that can incorporate into different formulations and textures. Due to its flexibility and breathability, this single step film can move along imperceptibly with human skin or makeup while also matching, improving and supporting the skin's appearance or makeup's wear via controlled, hyper-adhesion. How our novel film technology works? Figure 1 illustrates the mechanism of the film formation of ELC second skin technology via single step emulsion [1]. This unique exclusive technology is a water thin Si/W emulsion which contains low degree cross linked silicone rubber particles, which is soft with excellent adhesion. In addition, colloidal silica is incorporated in the Si/W emulsion to promote an invisible, soft and elastic film that fixes on skin via hydrogen bonding.

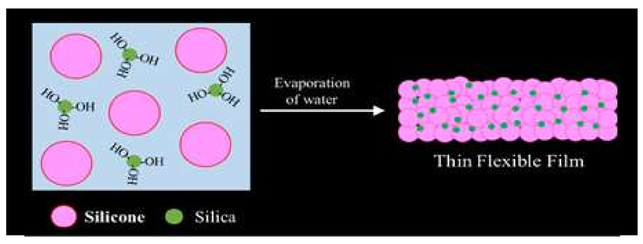


Figure 1: Mechanism of film formation for ELC second skin technology via single step emulsion

Materials & Methods:

- Tensile Strength and elongation test – Method: JSA-JIS K 6251 - Rubber, vulcanized or thermoplastic- Determination of tensile stress-strain properties. Device: TENSOMETER Model T2020 (Alpha Technologies)
- Film hardness test – Method: JSA-JIS K 6253-3:2012 Rubber, vulcanized or thermoplastic – Determination of hardness -- Part 3: Durometer method (Foreign Standard). Device: Niigata Seiki Durometer, Model No. ADM-A
- Breathability – Oxygen permeability study - Material: Polyurethane polymer, Alkyl Acrylates/Vinyl Acetate copolymer, Acrylates copolymer and Silicone-modified pullulan vs. ELC second skin technology. Method: Differential Pressure Method - oxygen permeability coefficient (Dk). Device: Toyo-Rika K-315-N-01G
- Breathability – Water Vapor permeability study - Material: Polyurethane polymer, Alkyl Acrylates/Vinyl Acetate copolymer, Acrylates copolymer and Silicone-modified pullulan vs. ELC second skin technology. Method: Water Vapor Permeability. Device: Water Vapor Transmission Rate Analyzer MOCON PERMATRAN-W 1/50
- Film flexibility test (Bending force) – Material: Cosmetic grade MQ Resin film former. Method: Bending force measurement - examine bending force of a film by measuring the force needed to bend the strip. Device: TA XT Plus Texture Analyzer with Bending force attachment
- Adhesion test – Material: Cosmetic grade MQ Resin film former. Method: Film adhesion measurement - examine adhesion of a film to the glass and measure the force needed to peel off. Device: TA.XT Plus Texture Analyzer with Adhesion instrument attached
- Transfer resistance test – Material: Product contains ELC second skin technology vs. market benchmark products of both transfer proof and non-transfer proof type. Method: Dynamic coefficient of friction force measurement. Device: TA.XT Plus Texture Analyzer with a sliding friction rig sled
- Tack Force and Payoff test – Material: ELC second skin technology vs. conventional non-transfer materials, A: Pentaerythrityl Tetraisostearate (PTIS), B: Sucrose Polycottonseedate (SP), C: Sucrose Tetraiostearate (ST), D: Silicone Resin (SR). Method: Quantify differences in the tack force of formulations using a TA XT Plus Texture Analyzer

Results & Discussion:

Result:

As results of our studies, we found that this second skin technology provides strong film with tensile strength of 2.6 Mpa, hardness of 38 and 610% elongation before breakage (Table 1).

Film Property	Harness (Durometer A)	35-42 (Avg. 38)
	Tensile Strength [Mpa]	2.1-3.3 (Avg. 2.6)
	Elongation at break [%]	560-640 (Avg. 610)

Table 1 – This second skin technology demonstrates strong film elongation, tensile strength and hardness.

This second sin technology provides superior breathability vs. conventional cosmetic film formers as demonstrated by oxygen and water vapor permeability study (Figure 2).

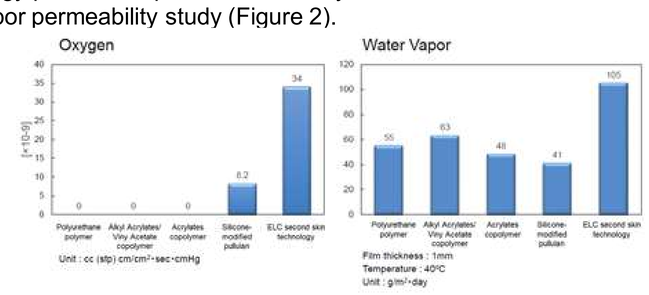


Figure 2 – Film Breathability Test – This second skin technology exhibits better Oxygen and Water Vapor permeability vs. other standard cosmetic film formers.

Bending force and adhesion test results (Table 2) indicate superiority of this second skin technology vs. traditional film former (MQ resin) with better adhesion, higher flexibility, and elasticity.

Name	Bending Force (g)	Adhesion (g)
ELC second skin technology	1.9	580
MQ Resin	0.3	500

Table 2 – Bending Force and Adhesion Tests

Film flexibility of this second skin technology is demonstrated in Figure 3. Under fixed weight, it stretches much further than the traditional polyurethane film, once the weight is removed, this second skin technology comes back to its original shape.

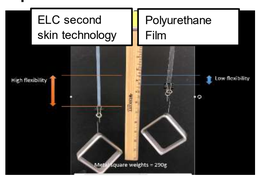


Figure 3 – Film Flexibility Demo

The friction and tack force test results show superiority of product containing this second skin technology in terms of payoff and non-transfer effect (Figure 4A). The second skin technology outperforms traditional topcoat materials with exceptional non-tacky finish (Figure 4B).

4A.

	Friction Force (g)
Product with ELC second skin technology	12.4
Transfer Proof Benchmark (Positive Control)	34.3
Non-Transfer Proof Benchmark (Negative Control)	54.4

4B.

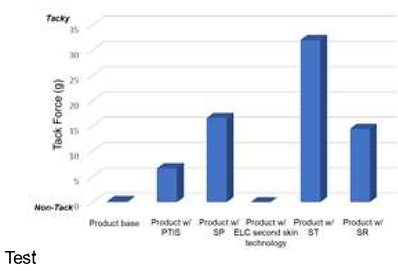
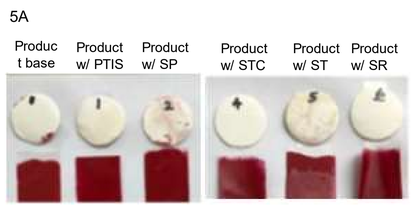


Figure 4 – Friction Force and Tack Test

ELC second skin technology demonstrated an excellent transfer resistance property as shown in Figure 5A and 5B.

5A



5B.

Figure 5 – Demonstrations for non-transfer property. (A) Tested transfer of a lip product to a paper cup. (B) Tested transfer pf a powder contained product and a lip product for skin to paper

Discussion:

Many long-wearing transfer-resistant cosmetic polymers film can be uncomfortable, tight on skin and develop a flaky appearance over time. On the contrary, ELC second skin technology provides long wear benefits across multiple categories of cosmetic formulations while providing a comfortable, flexible hold that quickly moves with facial expressions but remains in place for all-day wear.

The material science measurements demonstrated transfer resistance, breathability, adhesion and flexibility. Those results are confirmed with two consumer studies.

In the first study, product with ELC second skin technology was compared with external benchmark product. Panelists preferred product with ELC second skin technology to be lightweight sensory, soft/smooth and refreshing texture and pleasant application.

In the second study, utilizing product with ELC second skin technology in combination with BB Cream, which is a lightweight wear product on its own. Nearly all panelists indicated preferring the two products mixed vs. the BB cream alone, and combination was more comfortable and lightweight wear on their skin.

The oxygen gas and water vapor permeability study in Table 1 shows that our exclusive polymer is superior in terms of breathability comparing to other conventional polymers. The polymer is mimicking the skin properties by letting oxygen in and sweat out, resulting in a lightweight sensory.

Unlike conventional film formers used in cosmetic industry, ELC second skin technology provides natural skin-like flexibility and elasticity without compromising adhesion. This creates second skin-like film to deliver comfortable wear which stay in place and last all day.

Conclusions:

ELC second skin technology demonstrates unique capabilities in vitro and breakthrough performance in a consumer study. Due to its invisible, soft and elastic film with controlled hyper-adhesion, this technology provides fast drying, easy application, longwear and lightweight finish benefits to consumers. It is a strong candidate for use in multiple categories: moisturizers, serums, SPF, makeup, and hair care without any packaging limitations.

Aknowledgments:

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