Achieve Your Signature Style:
Film Former Options from AkzoNobel Personal Care

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AkzoNobel Surface Chemistry
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Outline

1. Global styling mega trends

2. AkzoNobel hair styling product portfolio

3. Featured polymers for delivering **volumizing** benefits
   - BIOSTYLE® CGP polymer
   - BIOSTYLE® XH polymer
   - CELQUAT® L-200 polymer

4. Featured polymers for delivering **thermal protection** benefits
   - AMPHOMER® polymer
   - DynamX® H₂O polymer

5. Summary
Global Styling Mega Trends
Hair Styling Trends and Consumer Benefits

Top claims for global hair styling new product development include:

• **Long-Lasting Hold**
  - 24 to 72 hour claims including volume, stiffness, humidity resistance, weather resistance

• **Shiny Hair**
  - Can be associated with moisturising claims (29% of brightening products also hydrate) to make hair look and appear healthier

• **Hair Volume and Thickening**

• **Men’s Styling**
  - In the last year, 15% of all styling launches are geared towards men (the most of any hair category), with favorite formats including gels, creams, putty, waxes

• **Multifunctionality**
  - Styling + additional benefits including conditioning, moisturizing, UV protection, thermal protection, color protection, etc. out of one product

• **Naturally-Derived & Organic Products**
  - 24% of recent styling launches marketed as natural

Source: Mintel GNPD; Hair Styling Products Category Insight, November 2015
# Hair Fixative Technology from AkzoNobel Personal Care

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Styling Consumer Benefit: Volumizing

BIOSTYLE® CGP polymer
BIOSTYLE® XH polymer
CELQUAT® L-200 polymer
Suggested Structure of BIOSTYLE® Polymers

INCI: Maltodextrin/VP Copolymer

BIOSTYLE® polymers are based on innovative, nonionic hybrid technology
Features and Benefits of BIOSTYLE® Polymers

INCI: Maltodextrin/VP Copolymer

A new option to satisfy customer and consumer demands for more sustainable products that aid in the hairstyling process

• Based on innovative, nonionic hybrid polymer technology
• Partial natural content offers a more sustainable formulating option
• Two molecular weight polymers are available
  – BIOSTYLE® CGP polymer provides similar performance compared to PVP K-30 or PVP/VA copolymer in working products
  – BIOSTYLE® XH polymer provides similar performance compared to PVP K-90 polymer in working products
• Improved hair volume boosting vs. PVP and PVP/VA copolymers
• Crystal clear solutions and styling products are now achievable with a naturally derived fixative polymer
• Provides exceptional gel clarity and robust Carbomer compatibility
CELQUAT® L-200 Polymer
Suggested Structure

INCI: Polyquaternium-4

Comb-Like Arrangement

Random Placement of Charges
Features and Benefits of CELQUAT® L-200 Polymer

• High performance polymer that offers superior hold with conditioning properties
  − Superior stiffness and high humidity resistance compared to other commonly used polyquaternium polymer benchmarks
  − Excellent combing properties and feel aesthetics in the wet and dry hair states

• Superior volume building properties for fine, thin hair

• CELQUAT polymer technology is derived from cationic cellulose
  − > 50% renewable content
  − Cellulose backbone offers superior aesthetics with a more natural component compared to other commonly used polyquaternium polymer benchmarks
BIOSTYLE® and CELQUAT® Polymers
Volume Evaluation

• Evaluate the on-hair volume building properties of our prototype vs. a commercial volumizing product using the shadow method

• Test is performed using 20 gram, 8.5-inch virgin European ultra fine hair swatches, where nine swatches per sample are evaluated

• Measurements are taken from the same swatch, before applying the styling product and then after product application

• Volume is characterized by the increase in swatch width
The hair width change is measured versus an untreated control with no product.

Both BIOSTYLE® polymer versions build more than twice the volume compared to PVP/VA and PVP K-90 polymers.
A Visible Difference in Volume Build
BIOSTYLE® XH Polymer

Blind salon evaluation comparing 2% BIOSTYLE XH mousse vs. blank mousse (no polymer)

BIOSTYLE XH | Blank Control

Blank Control | BIOSTYLE XH

BIOSTYLE® XH polymer generates significant volume build, particularly for consumers with fine hair
Volume Enhancement
CELQUAT® L-200 Mousse System

The hair width change is measured versus an untreated control with no product.

CELQUAT® L-200 polymer builds significant volume improvement compared to synthetic PQ-11 and PQ-16 polymers.

Basic Mousse
2% active polymer; 6% VOC systems

Conditions: 72°F (22°C); 50% RH

in-cosmetics 2016
A Visible Difference in Volume Build
CELOQUAT® L-200 Polymer

Blank Control | CELQUAT L-200

CELQUAT L-200 | Blank Control

CELOQUAT® L-200 polymer generates significant volume build, particularly for consumers with fine hair.

Blind salon evaluation comparing 2% CELQUAT L-200 mousse vs. blank mousse (no polymer)
Volumizing Summary

• The BIOSTYLE® polymers provide superior volume build and texture to hair compared to the PVP and PVP/VA copolymer benchmarks.

• CELQUAT® L-200 polymer builds more than double the volume when compared to Polyquaternium-11 and Polyquaternium-16 market benchmarks.

• These AkzoNobel styling polymers are derived from partial renewable resources to aid in volume building and improved on-hair aesthetics:
  – BIOSTYLE polymers derived from maltodextrin
  – CELQUAT polymers derived from cellulose
Styling Consumer Benefit: Thermal Protection

AMPHOMER® polymer

DynamX® \( \text{H}_2\text{O} \) polymer
AMPROMER® Polymer
Suggested Structure

INCI:
Octylacrylamide/Acrylates/Butylaminoethyl Methacrylate Copolymer

\[
\begin{align*}
R_1 &= \text{alkyl} \\
R_2 &= (\text{hydroxy})\text{alkyl}
\end{align*}
\]
DynamX® H₂O Polymer Suggested Structure

INCI: Polyurethane-14 (and) AMP-Acrylates Copolymer

- Flexibility, Removability
- Memory
- Removability

- End Capper
  - IPDI
  - PPG
  - IPDI
  - Rigid Diol
  - IPDI
  - DMPA
- Acid
  - (Meth)acrylates

Flexibility
Stiffness, High Humidity Curl Resistance
Features and Benefits of AMPHOMER® and DynamX® Polymers

**AMPHOMER® Polymer**
INCI: Octylacrylamide/Acrylates/Butylaminoethyl Methacrylate Copolymer
- Amphoteric
- Superior film forming properties
- Market-leading stiffness
- 72 hour high humidity resistance
- Thermal protection*
- Weather resistant

*AMPHOMER polymer technology covered under US Patent 9,119,972 B2

*Recommended use level: 1-6%

**DynamX® H₂O Polymer**
INCI: Polyurethane-14 (and) AMP-Acrylates Copolymer
- Anionic polymer, pre-neutralized with AMP
- Supplied as a 25% active aqueous solution for maximum formulation versatility
- The polyurethane portion provides low tack, memory, durability, and flexibility
- The acrylate portion offers strength, humidity resistance and some rigidity
- Overall gives flexible styling, curl definition, anti-frizz properties, thermal protection, and high shine

*Recommended use level: 1-6% active*
Thermal Protection Testing and Analysis

- Heating process involved 10 cycles of:
  - Applying appropriate polymer spray to dry hair swatch
  - Applying heat via flat iron at highest setting (450°F / 232°C) for 1 minute
  - Washing swatch with 1.5cc of Prell shampoo
  - Drying swatch in 45°C oven for 15 min

- Control sample was run similarly without polymer applied

- Each sample was evaluated for wetting force using dynamic surface tension analysis
SEM Analysis

• Scanning Electron Microscopy

• Performed to understand physical differences between damaged and undamaged hair and the polymer protection impact

• Images are of a single fiber taken from a hair tress tested for each polymer

• Images are shown at 10,000 magnification

• SEM analysis was performed via a blind study at an AkzoNobel Surface Chemistry research facility in Brewster, NY
Scanning Electron Microscopy Analysis
Polymer Solutions

**Untreated**

**Heat Treated (no film former)**

**AMPROMER® polymer after heat treatment**

**DynamX® H₂O polymer after heat treatment**

Conditions: 1% active aqueous solutions, neutralized 100% with AMP; 12 heat cycles at 450°F / 232°C
Thermal Protection
Wetting Force Analysis

- Single hair fibers were dipped in water to determine the wetting force of the fiber.
- Data was recorded starting the instance the hair breaks the surface of the water until the point where the hair fiber was submerged 3 mm.
- Data is reported in mN (millinewtons), representing wetting force, and corresponds to the depth at which the hair is submerged.
- An average of 300-450 measurements were taken for each hair fiber.
- To ensure statistical accuracy, 12 hair fibers for each sample were evaluated.
- The larger the wetting force, the more damaged the hair fiber.
- Damaged hair is more hydrophilic.

Kruss Tensiometer
Thermal Protection Wetting Force Analysis

Aqueous Solutions:
1% active polymer, 100% neutralized with AMP

- Virgin Hair
- AMPHOMER® polymer
- DynamX® H2O polymer
- Heat Treated Control

- The larger the wetting force, the more damaged the hair fiber
- Acrylate polymers provide the most protection from thermal damage, followed by urethane material
- Among the products tested, AMPHOMER® polymer delivers the best protection
Thermal Protection Summary

• AMPHOMER® polymer offers superior thermal protection properties against the damaging effects of blow dryers, hot flat irons and styling implements
  – Technology is patent protected in the US

• DynamX® H₂O polymer also provides thermal protection properties for a softer, more natural look and feel

• Both products offer 450°F / 232°C heat protection claims
Achieve Your Signature Style

Summary

AkzoNobel Personal Care offers a wide range of synthetic and naturally-derived ingredients that provide consumer perceivable styling benefits, including:

- Hair Conditioning
- **Volume Boosting**
- Curl Definition
- Humidity Defense
- **Thermal Protection**

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