ACULYN™ 46N Rheology Modifier/Stabilizer

Description

An efficient shear thinning thickener compatible with cationics

ACULYN™ 46N Rheology Modifier/Stabilizer is a nonionic **H**ydrophobically-modified **E**thoxylated **UR**ethane **(HEUR)** thickener designed for personal care applications. As with other ACULYN rheology modifiers, the polymer is a liquid product for easier handling and manufacturing efficiency. ACULYN 46N is offered at 18 to 20% solids, is stable from pH 2 to 12 and compatible with peroxide and other oxidizing agents. The polymer has a well-established toxicological profile and is safe in normal use.

CTFA/INCI Name: PEG-150/Stearyl Alcohol/SMDI Copolymer

Features

- Highly associative
- Peroxide stable
- Yields clear gels
- Particulate stabilizer
- Pseudoplastic rheology
- Cold-processable
- Nonionic
- Liquid
- Stable In anionic, cationic, nonionic and Zwitterionic surfactant systems
- Formulation compatible
- Stable pH/viscosity response
- Acid compatibility
- Lack of odor
- Salt tolerant

Applications

- Cationic silicone emulsions
- Creams
  - Make-ups
  - Mascara
  - Alpha-Hydroxy acid creams
- Hair Products
  - Permanent waves
  - Conditioners
- Peroxide-containing formulations
  - Hair bleaches/dyes
  - Hydrogen peroxide skin disinfectants

Benefits

- Easy to handle
- Can be used with electrolytes
- No neutralization necessary
- Ability to stabilize suspensions
- No preparation necessary
- Compatible with nonionic, anionic, Zwitterionic and cationic surfactants
- Non-hygroscopic
- Increased manufacturing efficiency
- Stable in pH 2 to 12 formulations
- Allows for use of continuous production processes with use of in-line static mixers
- Effective In thickening acid media such as solutions of organic acids
- Can be processed with membrane pumps and, when diluted, with turbine mixers and high speed propellers
- Thickens and stabilizes oxidizing media
- Able to formulate clear products
- Supported by comprehensive environmental, health and safety data
- Mild, soft, non-greasy, non-sticky
- Reproducible viscosity
- Stabilization of hydrophobic (low solubility) components

Physical Properties

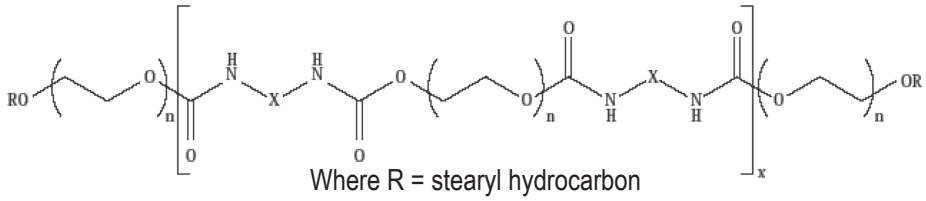
The following are typical properties of ACULYN™ 46N Rheology Modifier/Stabilizer; **they are not to be considered product specifications.**

INCI Name: ..... PEG-150/Stearyl Alcohol / SMDI Copolymer
Chemistry: ..... HEUR
Association: ..... Very high
Ionic nature: .....Nonionic
Appearance: ..... Hazy liquid
Solvent: ..... Water / enzymatically modified starch solution (5 to 6%)
Solids,%: 18.5
pH (as supplied): 6-8
Density: 1.0-1.2
Rheology: ..... Stringy, tacky
Shear thinning: ..... Very high
Viscosity, mPa s (as supplied): ..... < 3,000
Pseudoplastic index: 6.0
(6 rpm/viscosity @ 6.0 rpm): ..... (1% solids In water, activated with surfactant)

ACULYN™ 46N Rheology Modifier/ Stabilizer

ACULYN™ 46N Rheology Modifier/Stabilizer Is a **H**ydrophobically·modified **E**thoxylated **UR**ethane **(HEUR)** and Is synthesized from stearyl alcohol, a diisocyanate and a polyethylene glycol. The general structure for ACULYN 46N Is shown below.

Structure



Where R = stearyl hydrocarbon

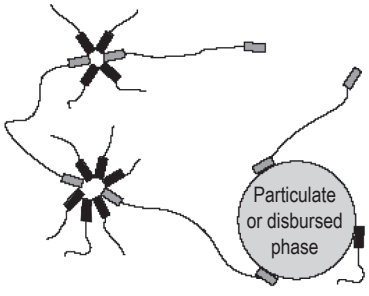
Mechanism of Action

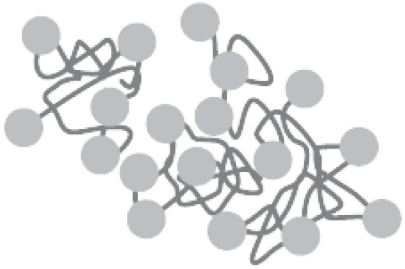
ACULYN™ HEUR rheology modifiers thicken via an associative mechanism. The hydrophobic parts of HEUR polymers build up associations with other hydrophobes present in the formulation. However, because the polymer is nonionic in nature, no neutralization is needed and the polymer will function equivalently in a pH range from 2 through 12.

The pendant hydrophobic groups in ACULYN HEUR polymers are free to build associations with one another and with other hydrophobes available in the formation, such as surfactants, particulates, emulsion droplets and dyes. This phenomenon creates a network structure that results in a significant viscosity build.

Associative Rheology Modifier

These associative structures can also act to stabilize and disperse particulates in a formulation.





The chart below shows features indicative of the behavior of HEUR rheology modifiers under different conditions. Please note that these behaviors may vary to some extent according to specific formulations.

All ACULYN™ rheology modifiers are easy to formulate, have good to excellent salt tolerance, compatibility with anionics and nonionics and low odor. Additionally, HEUR polymers have excellent compatibility with low pH and cationic systems and excellent stability in one-part peroxide systems.

Features of HEUR Rheology Modifiers

Ease of formulation	Good
Associative	Yes
Salt tolerance	
NaCl	Excellent
Di/trivalent ions	Excellent
Shear thinning behavior	Good
Residual monomer levels	Very Low
Solvent compatibility	Good
Low pH compatibility	Excellent
Anionic surfactant compatibility	Good
Nonionic surfactant compatibility	Excellent
Cationic surfactant compatibility	Excellent
Zwitterionic surfactant compatibility	Excellent
Peroxide stability	
1 part system	Excellent
2 part system	Excellent
Lack of odor	Excellent

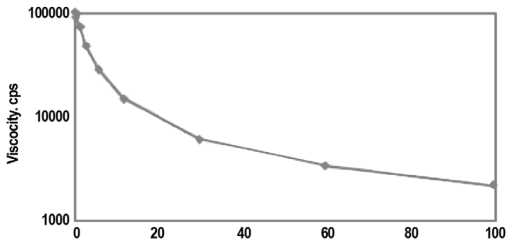
ACULYN™ 46N Rheology Modifier/ Stabilizer Behavior Profile

ACULYN™ 46N Rheology Modifier/Stabilizer possesses many properties that make this polymer highly desirable for use in personal care applications, as shown in the data presented below.

Rheology

ACULYN 46N has a positive effect on the feel of formulations. When a formulation is shear thinning, such as in the interaction of ACULYN 46N with dicetyl dimethyl ammonium dichloride (DCDMAC), which is shown in Figure 1 below, it tends to feel 'heavy' or less oily on the skin.

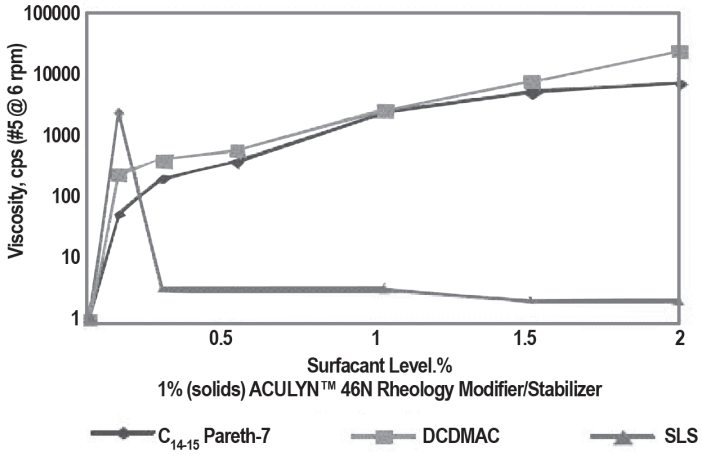
Figure 1.



Surfactant Interactions

ACULYN 46N does not interact strongly with hydrophilic surfactants such as sodium lauryl sulfate (SLS) because the hydrophobe on the surfactant (C_{12}) does not counterbalance the high hydrophilicity of the sulfate group. However, when a more hydrophobic surfactant such as the C_{14-15} pareth-7 surfactant is employed, the longer chains (C_{13}, C_{14}, C_{15}) and the lower hydrophilicity of the ethylene oxide groups causes the surfactant to interact/associate with the ACULYN 46N. This association effectively builds a network and structure in the solution, causing an increase in viscosity. Dicetyl dimethyl ammonium chloride (DCDMAC) is even more hydrophobic, and consequently interacts more strongly with ACULYN 46N. The viscosity at higher surfactant levels (1.5% and 2% surfactant) is greater with DCDMAC than with the C_{14-15} pareth-7, indicating a stronger interaction and a stronger network in solution. See Figure 2.

Figure 2. Thickening with ACULYN™ 46N Solutions Containing Various Surfacants



Formulations and Use Guidelines

ACULYN™ 46N Rheology Modifier/Stabilizer is compatible with cationic surfactants, acids and peroxides as well as other ingredients commonly found in cosmetic and toiletry products.

This product is shipped as a low viscosity water-based liquid that thickens on addition to a formulation due to interactions with a surfactant or dispersed phase. A proprietary solvent-free viscosity suppressant is used to provide ease of handling of the ACULYN 46N HEUR polymer as it is shipped. When the ACULYN 46N HEUR rheology modifier is added to the formulation, the viscosity suppressant is released from the ACULYN 46N polymer, allowing the thickener to interact with the ingredients in the formulation.

This technology accounts for the behavior of ACULYN 46N when it is added to a formulation containing a surfactant. Depending on the surfactant type, a small amount of surfactant will increase the viscosity dramatically until a maximum is reached. After reaching this maximum, the ACULYN 46N polymer will behave like a traditional associative thickener or rheology modifier.

ACULYN 46N should be added slowly and steadily near the periphery of the mixing tank. The rate of addition should be adjusted to allow uniform incorporation of the thickener. Rapid addition may cause excessive thickening or flocculation due to highly localized thickener concentrations.

To ensure optimum performance of the ACULYN 46N, the following procedure is recommended:

1. Introduce most of the formulation water into the reactor.

2. Add ACULYN 46N polymer and stir vigorously for a minimum of 5 minutes.

3. Add the most hydrophilic (high HLB) surfactants and ingredients and stir for a minimum of 5 minutes.

4. Add the remaining components, saving the most hydrophobic component for last.

Toxicology and Ecotoxicology

For product safety, refer to the Safety Data Sheet (SDS).

Handling Precautions

Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

Storage

Store products in tightly closed original containers at temperatures recommended on the product label.

Disposal Considerations

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Dow Technical Representative for more information.

Dow is a member of the American Chemistry Council (ACC) and is committed to the ACC's Responsible Care® Program.

Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products – from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including Safety Data Sheets (SDS), should be consulted prior to use of Dow products. Current Safety Data Sheets are available from Dow.

Contact:
North America: 1-800-447-4369
Latin America: (+55)-11-5188-9000
Europe: (+800)-3-694-6367
(Toll) +31-11567-2626
Asia-Pacific: (+800)-7776-7776
(Toll) +60-3-7965-5392
http:www.dow.com