Goldschmidt Industrial Specialties

Base Oils of Antifoams – A Comparison

Technical Service – Plastic Industries
Base Oils of Antifoams

Basic material:

- Polydimethylsiloxane (PDMS or silicone oil)
- Organic oils
- Polydimethylsiloxane + organic ligands

Antifoams based on:

- 100 - 1 Mio. mPas
- OH-functional - oil
- Alkoxy functional - oil

- Vegetable oil
- Mineral oil
- White oil
- Polyethers

- Organomodified siloxane - OMS
Antifoams Based on Silicone Oil

Efficiency:
Silicon oil has a low surface tension in the range of 20 mN/m
→ Excellent antifoaming action

Compatibility:
Negative side effects in most applications
→ i.e. wetting defects in film applications
Wetting Defects Caused by Antifoams Based on Silicon Oil

High formation of craters and fish eyes lead to severe problems in terms of:

→ Coatability
→ Print- or Paintability
→ Delamination / Loss of Adhesion

Therefore silicone oil based products are banned from many demanding applications!
Efficiency:
Organic oils have a surface tension in the range of 30 mN/m → antifoaming action is much less compared with silicone oil based products

Compatibility:
Less or no negative side effects in most applications. → Less wetting defects in film applications
The wetting defects are very low. But organic based antifoams might lead to the following problems:

→ Difficult Coatability due to stronger foaming
→ Mineral oil based products cause fogging
→ Generation of VOC

Organic based products might show good compatibility, but for high demanding applications there are certain draw backs.
Antifoams Based on Organomodified Siloxanes

Efficiency:
OMS has a low surface tension in the range of 20-25 mN/m
→ Excellent antifoaming action

Compatibility:
Because of its high organic share in the molecule the compatibility is excellent
→ no wetting defects in film applications
Organomodified siloxanes combine good compatibility with good defoaming properties:

- No foam built up on machines or during handling
- No defects or fish eyes due to the defoamer

Organomodified siloxanes ensure a defect free application of dispersions and therefore ensure a continuous production for high demanding applications.
Organomodified Siloxanes / Linear Structure

PDMS

R–Si–O–Si–O–Si–R

OMS

CH₃–Si–O–Si–O–Si–CH₃

CH₃–Si–O–Si–O–Si–CH₃

CH₃

n
Organomodified Siloxanes / Comb-like Structure

PDMS

\[ \text{CH}_3 \text{Si} - \text{O} \left( \begin{array}{c} \text{CH}_3 \\ \text{CH}_3 \end{array} \right)_n \text{Si} - \text{O} \left( \begin{array}{c} \text{R} \\ \text{CH}_3 \end{array} \right)_m \text{Si} - \text{CH}_3 \]

OMS
Organomodified Siloxanes / Branched Structure

PDMS

\[ \begin{align*}
\text{CH}_3 &- \text{Si} - \text{O} & \text{Si} - \text{O} & \text{Si} - \text{CH}_3 \\
\text{CH}_3 &- \text{Si} - \text{O} & \text{Si} - \text{O} & \text{Si} - \text{CH}_3 \\
\text{CH}_3 &- \text{Si} - \text{O} & \text{Si} - \text{O} & \text{Si} - \text{CH}_3 \\
\text{CH}_3 &- \text{Si} - \text{O} & \text{Si} - \text{O} & \text{Si} - \text{CH}_3 \\
\end{align*} \]

OMS
Organomodified siloxanes / OMS: Good Defoaming + Good Compatibility

Organic based oils: Lower Defoaming + Good Compatibility

PDMS: Good Defoaming + Low Compatibility