

Solutions for Your TOUGHEST
MIXING Applications in

CHEMICALS

Introduction

Dispersion of

The Process

Fumed Silica

The Problem

The Solution

The Advantages



CHEMICALS

Dispersion of Fumed Silica

Fumed Silica (also called colloidal silica) is a fluffy white powder with an extremely low density, marketed under trade names such as Aerosil® and Cab-o-sil®*. With both hydrophobic and hydrophilic grades available, it is widely used as a rheology modifier, imparting highly thixotropic properties at relatively low percentages. It can also provide increased tack, better stability in suspensions and prevents “sagging” and settling of solids in a liquid system. For this reason it is particularly suitable for coatings, inks, adhesives, resins, sealants, and greases.

Fumed silica is also used in some pharmaceutical and cosmetic applications.

The Process

Despite the diversity of end uses, and the various processing methods and equipment used, (ranging from simple agitators to milling equipment) there are a number of common processing requirements which must be satisfied in order to obtain maximized “functionality”:

- Mixing equipment must be capable of rapidly incorporating and dispersing the powder into the base liquid.
- Shear is required to obtain functionality. The dispersion equipment used has as much of an effect on the viscosity obtained as the concentration of fumed silica. This must be taken into account when formulating products or altering processing conditions.
- Vigorous in-tank movement must be maintained as the viscosity rises.

The Problem

Using conventional mixers and agitators, a number of problems can be encountered during production:

- The powder is very low density and is extremely difficult to “wet out”; it floats on the liquid surface.
- As the powder is extremely fine it poses real problems due to dusting.
- Long processing times are required to fully disperse the powder once it is wetted out.
- Low-shear mixing devices are generally unsuitable for dispersing fumed silica. While the powder may be wetted out, the lack of high shear mixing results in poor yield of thickening effect.
- Formulations often contain excessive percentages of fumed silica to compensate for poor yield.
- Incorrect dispersion can lead to great inconsistency between batches, especially when excessive loadings have been used.

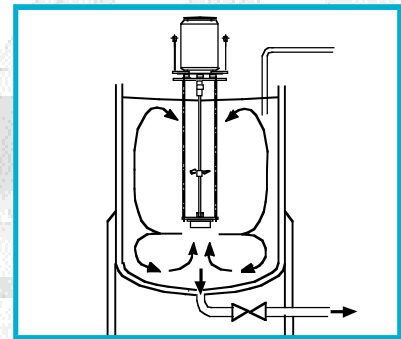
The Solution

These problems can be overcome by using a Silverson high shear mixer. Immersion units for batch operation, In-Line devices, and Flashblend powder/liquid mixing systems are used for this application, the selection of which depends on factors including batch size, raw materials and the viscosity of the end product, see opposite for details:

* Registered trademarks of Degussa AG and Cabot Corp. respectively

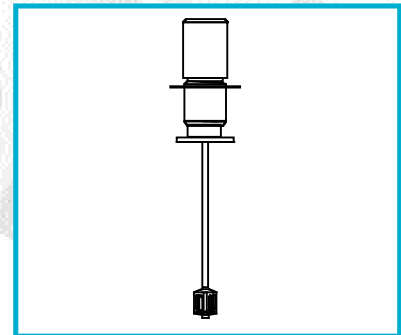
High Shear Batch Mixers:

- Suitable for small batches
- Explosion Proof units available, UL and CSA approved for Class I, Group D
- Sealed units available
- Special units for abrasive products available
- “V” Range mixers available with inverted workhead for incorporating low density powders which float or “raft” on the liquid surface



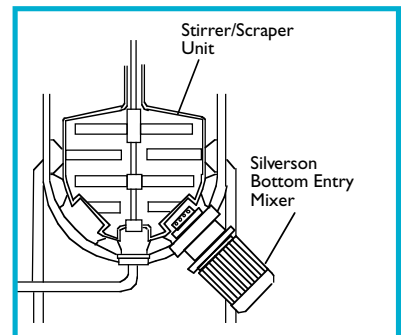
Silverson Ultramix

- Ideal for larger batches
- Capable of rapidly incorporating large volumes of powders
- Suitable for high viscosity mixes
- Single-piece dynamic mixing head designed for CIP



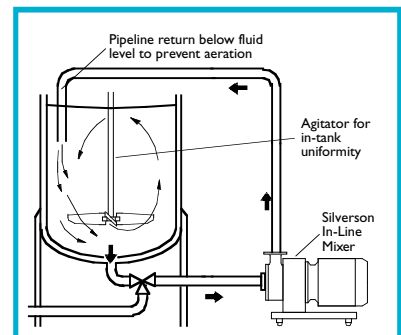
High Shear Bottom Entry Mixers.

- Normally used in conjunction with an anchor stirrer/scraper on high viscosity products; can be used alone on lower viscosities.
- Variable speed can be obtained with an inverter



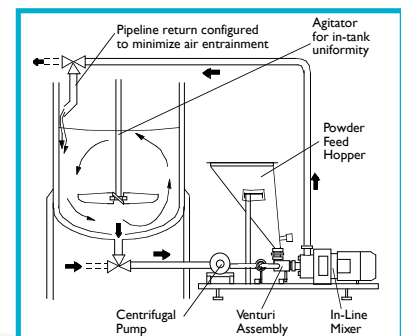
High Shear In-Line Mixers

- Ideal for larger batches
- Aeration free
- Must be used in conjunction with an efficient in-tank agitator to wet out powder
- Easily retro fitted to existing plant
- Self pumping, depending on product viscosity
- Multistage units available for higher degree of shear



Silverson Flashblend

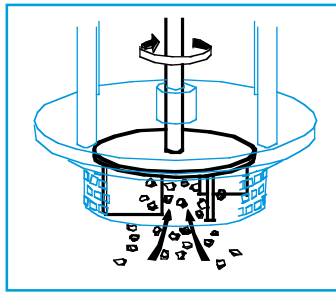
- Ideal for larger batches
- For rapid incorporation of large volumes of powders
- Controlled powder addition rate
- Minimum operator input required
- Can be integrated with bulk powder dispensing systems e.g. Bulk Bags (FIBCs)
- Silverson should be consulted regarding systems involving flammable solvents/resins



The Advantages

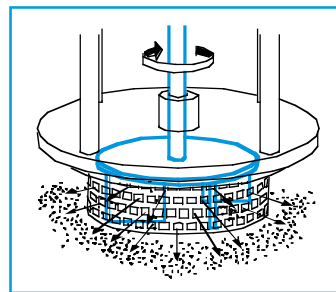
- Fine dispersion results in improved product quality and stability
- Agglomerate-free mix
- Consistent product quality and repeatability
- Shorter processing times reduce wear to mechanical parts
- Hard tipped rotors and hard surfaced shafts are available as optional extras where abrasive materials are processed
- Some grades of fumed silica are “pumpable” and behave like fluids. The powder can then be pumped from containers directly into the rotor, eliminating dusting/handling problems.

These advantages stem from the 3 stage mixing action of the Silverson rotor/stator assembly. Operation is as follows::



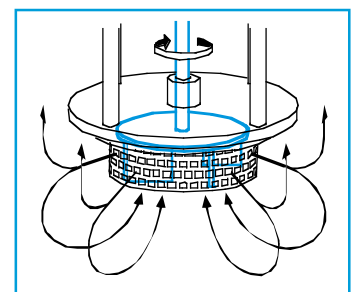
Stage 1

The powerful suction created by the high speed rotation of the rotor blades draws both liquid and solid ingredients into the workhead where they are rapidly dispersed.



Stage 2

Centrifugal force drives the materials to the periphery of the workhead where they are subjected to a milling action in the precision gap between the tips of the rotor blades and the inner wall of the stator.



Stage 3

The product is expelled from the head and projected back into the body of the mix. Fresh materials are simultaneously drawn into the head. In a short mixing cycle all the material passes through the workhead many times, rapidly becoming fully dispersed.



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