TBPS 454

Di-tert-butyl-Polysulfide
CAS No: 68937-96-2

Refinery Applications

TBPS 454 is a sulfiding agent which is used, along with a reducing agent such as hydrogen, to transform metal oxide species to a metallic sulfide crystalline phase *in situ* for hydrotreating catalysts. For *in situ* sulfiding the reaction is performed inside the process unit for complete control and to achieve maximum catalyst activity and safe handling.

Packaging

TBPS 454 is available in bulk (tank trucks and ISO containers) or packaged containers including 250 gallon plastic totes and 54 gallon drums.

Advantages

Unlike other sulfiding agents, TBPS 454 is not classified as a flammable material. It also has a low toxicity rating. TBPS 454 has a diesel like odor, a more friendly and common smell for refineries. TBPS 454 also starts to convert to H_2S at the lowest temperature compared to other sulfiding agents, lowering the risk of reduction of metals and potentially lessening the time of the sulfiding operation. The hydrocarbon byproduct during a sulfiding operation for TBPS454 is isobutane, which does not have the potential to dilute hydrogen in the recycle gas during a sulfiding operation.

Safety and Handling

TBPS 454 is an environmentally hazardous substance and a marine pollutant. It also has a high viscosity rating, making it difficult to handle during cold weather. It is not soluble with water but is soluble in hexane and white spirits. TBPS is compatible with both carbon and stainless steel. Teflon or Viton gaskets are recommended for the injection of TBPS 454. There are no known incompatible materials. Household bleach (not pure bleach) or Liquid Alive® bacteria is suggested for any needed clean up. Please reference the MSDS for additional handling and safety recommendations.

Sulfiding Agent Properties

Characteristics	DMDS	TBPS454	DMS
Sulfur % (wt)	68	**54**	52
Density (lbs/gal)	8.9	**9.0**	7.11
Freezing Point (°F)	-121	**-54**	-145
Boiling Point (°F)	229	**N/A**	99
Flash Point (°F)	59	**217**	-36
Vapor Pressure at 70°F (PSI)	.45	**<.1**	8.1
Decomposition Temperature* (°F)	392	**320**	482
Auto Ignition Temperature (°F)	575	**437**	403
Viscosity at 70°F (mPa.s)	.62	**12.8**	.285

**In the presence of H_2 and Catalysts*

Product Safety Information

Material Safety Data Sheets are available upon request and on our website:

www.cpchem.com/specialtychemicals

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TBPS 454 Cont'd

Application Guidelines

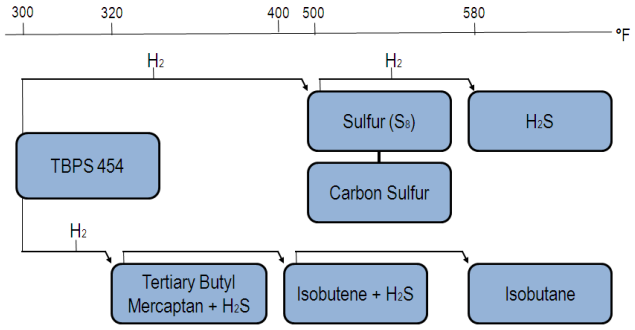
For *in situ* sulfiding of hydrotreating catalysts, the catalysts will typically be dried and then wetted with feed material at 300°F or below. TBPS 454 injection begins as the temperature approaches 400°F, with the reactor held in a range of 400–420°F until H_2S breakthrough occurs. Breakthrough is indicated when the H_2S level of the recycle gas exceeds 5000 ppm. The reactor temperature can then be raised to the secondary sulfiding plateau, which is typically in the range of 620–670°F. The temperature will be held at this level for at least 4 hours until the sulfiding process is complete. A secondary H_2S breakthrough may occur at this point, with H_2S levels rapidly exceeding 20,000 ppm (see Figure 2).

The decomposition behavior of TBPS 454 in the presence of a catalyst is illustrated in Figure 1. During activation, TBPS 454 generates the essential H_2S required for an effective sulfiding through the two noted decomposition pathways. To ensure optimal H_2S formation and avoid adverse reactions, it is important to maintain proper procedures, including adequate hydrogen availability and accurate injection rates for any sulfiding agent. Decomposition chemicals isobutane and isobutene typically exist in the high-pressure separator with liquid hydrocarbons which potentially improves purity of the hydrogen recycle gas vs using DMDS. The injection point should be as close as possible to the catalyst bed especially for a gas phase sulfiding.

Comparison of Other Polysulfides

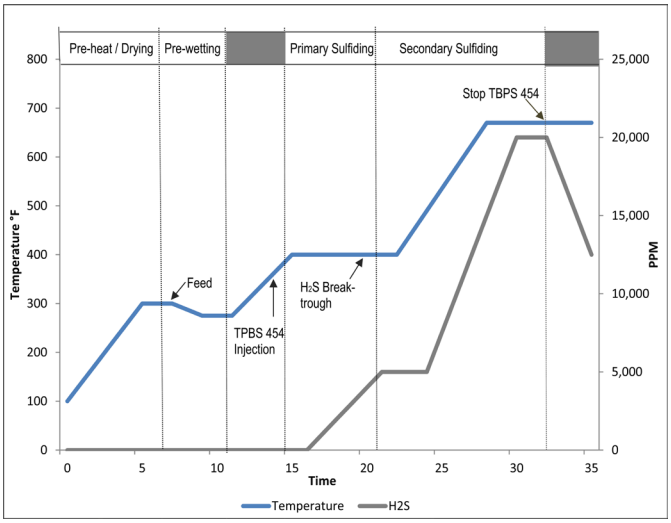
TBPS 454 is a non-distilled di-tertiary butyl polysulfide containing predominantly tetra- and penta-sulfides, and it offers the highest sulfur content among manufactured polysulfides. It is also used as a gear-oil lubricant. Other available polysulfides—TNPS 537, TDPS 532, and TDPS 320—are commonly used in extreme-pressure and metalworking lubricant formulations for anti-wear protection.

Figure 1. Decomposition of TBPS 454 in the Presence of a Catalyst



Actual results may vary depending on unit pressure and conditions

Figure 2. Typical Feed Sulfiding Procedure



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