Substance Identification Document

Frits, chemicals - EC# 266-047-6, CAS# 65997-18-4

***NOTE**: This document contains the information on substance identity and description of the compositions included in the EU REACH dossier for frits, chemicals.*
Importantly, only frits classified as hazardous under CLP Regulation are registered in EU REACH. Non-hazardous frits are exempted from Registration.

Substance Name: Frit, chemicals

IUPAC name: Frits

EC Number: 266-047-6

CAS Number: 65997-18-4

Type of substance: Inorganic, UVCB.

UVCB sub-type 2, where the source is chemical or mineral and the process is a synthesis.

UVCB substances definition[1]: There are substances for which the number of constituents is high, or the composition is to a
significant extent unknown, or the variability of composition is large or unpredictable. In these cases, a clear identification based on the chemical composition only is not possible and these will need to be considered as a substances of Unknown or Variable composition, Complex reaction products or Biological materials (UVCB).

Molecular formula: Not applicable for UVCB substances

[1] Identification and naming of substances under REACH and CLP; version 2.0, April 2017
https://echa.europa.eu/documents/10162/23036412/nutshell_guidance_substance_en.pdf/cca556cd-4f68-4b38-a29b-58cb6da31a93

Frit production process description and vitreous structure

The manufacturing process is the key parameter to define this UVCB substance. The frits are produced via the reaction product of melting at high temperature, and then rapidly quenching, a mixture of the raw materials (generally inorganic oxides). During the manufacturing process, chemical bonds of the raw materials are broken and these elements are rearranged and ionically interdiffused within the vitreous lattice of the frit. Frits do not present crystalline phases in their composition, but an amorphous structure in which the different constituents are interdiffused and bound.

The constituents listed in each frits profile composition are expressed in the form of metal oxides, as these are usually the starting materials. In addition to oxidic forms of the main constituents, frits may include other elements provided that they do not affect the classification scheme.

It would be very difficult to define the ratio of the main source substances that take part in the chemical reaction during the melting step, because the fritting process is not a stoichiometric reaction. Different proportions of main constituents can develop very similar vitreous lattices, in terms of strength and stability.

The main steps in the manufacturing process of frits are described next:

1. The raw materials are usually delivered by tanker and fed pneumatically into a silo, and weighing is done automatically.
2. The mixture of raw materials is pneumatically fed to a silo (feeding hopper) next to the kiln, and then automatically fed by screw into the kiln.
3. Chemical reactions take place during the melting process at temperatures between approximately 900-1600 °C. These temperatures are achieved by the use of several high temperature burners (depending on the size and the design of the kiln), working on air/gas or oxygen/gas combustion process. For this reason, the pressure inside the kiln is not a critical parameter and the usual values are always ± 10% around the atmospheric pressure. The dwell time of the melting material inside the kiln varies between 1-2 hours, in order to avoid the presence of unmolten particles from the starting materials (crystalline structures) inside the vitreous phase of the resulting frit.
4. The molten mixture is rapidly cooled. This is done by quenching the reaction mass in water, or alternatively by using cooled rollers (dry quenching).
5. Frits are automatically extracted from the quenching bath and fed into a silo/big bag using a conveyer belt.

The manufacturing process is shown in Figure 1 below.

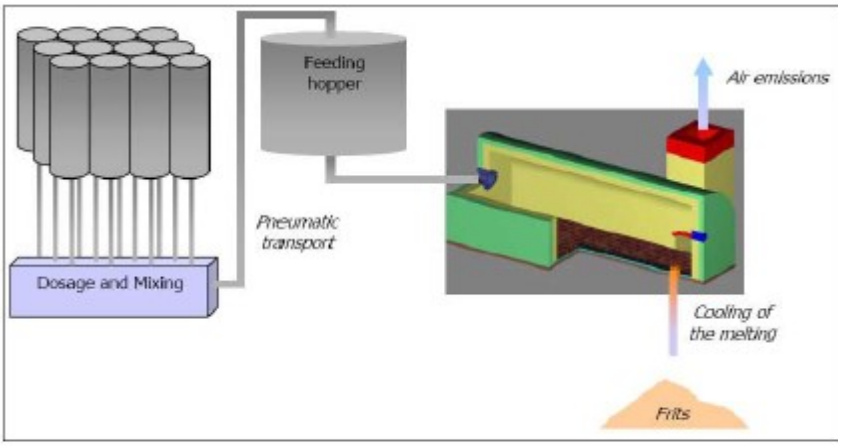

Figure 1. Manufacturing process of frits

The final frit obtained is a solid substance in form of flakes or granules, in which the elements constituting the raw materials have been rearranged and are now an integrated part of a vitreous matrix. Afterwards, frits can be grinded to a powder, milled with water to a slurry, or be used directly in granular form.

Additional parameters typically relevant to describe other UVCB substances, such as extraction/isolation steps or clean-up/purification steps, are not relevant in the case of manufacture of frits. This is due to the chemical nature of the frits. Fritting process has been basically developed to incorporate soluble starting materials inside an insoluble vitreous