SWeRF

Sample name	**Date:** 16/04/2015	**Sample** 5			**Cryst. Silica cont.**	20.0 7	
Sample identification		Density =	2550	kg/m3	CS Density =	2650 6	/m3
		SWeRF =	**18.2** 8	%	**SWeRFcs =**	**3.5** 9	%

D 50 2	4.26	3
Spec.Surface	0.60	
Span	1.09	4
Diameter (µm)	Cum. (%)	
0.02	0.00	
0.03 1	0.00	

Guide for using to the calculation, sedimentation excel sheet.

Please enter your own data in the cells with this layout. The values in this sheet are only an example.

Notes	
1	Use a **cumulative** particle size distribution (PSD) and start with the lowest diameter (but not zero). SWeRF is based on EN481 for which it is necessary to convert the particle diameters to aerodynamic diameters. Therefore a method of analysis of the PSD should be chose that represents the sample the most accurately with regard to its behaviour in air.
2	Enter a number between 0 and 100 to calculate a percentage point (e.g. D50)
3	Specific surface is calculated using the PSD [1] the density[5] and the assumption particles are spheres.
4	Relative span* is also calculated from the PSD. A low span indicates a narrow PSD, while a high span indicates a wide PSD. *Instead of D50, the harmonic mean of D10 and D90 is used in order to prevent the effect of skeyness
5	Enter the density of the sample.
6	Enter the density of the crystalline silica.
7	Enter the amount (%) of crystalline silica in the sample (not the residue).
8	The SWeRF (of the total sample) is calculated based on the PSD [1] and the density of the sample [5].
9	The SWeRFcs (the SWeRF of the crystalline silica in the sample) is calculated using the PSD [1] of the sample, the density of the CS [6] and the content of CS determined in the sample [7].
10	Enter the viscosity and the density of the fluid that is used for the sedimentation. When water is used the viscosity and density are automatically calculated from the water temperature.
11	Enter the weight of the sample. To ensure unhindered sedimentation the volume of solids should be maximum 1 % (or e.g. maximum 2.5% for a material with density of 2500 kg/m3)
12	Enter the dimensions of the used sedimentation column. Make sure that the column is high enough to allow for an undisturbed separation of the supernatant (top layer).
13	In order to determine the SWeRFcs (sedimentation), the density of the crystalline silica [6] is used to determine the time of sedimentation.
14	After sedimentation for the required time, the supernatant is removed and the amount of residue determined by drying. In this residue the concentration of crystalline silica has to be determined and entered here.
15	The SWeRFcs is calculated using the amount of residue and the concentration of cs in the residue.
16	For the verification the time of sedimentation is calculated using the density [5] of the sample (not the crystalline silica)
17	After sedimentation for the required time [16], the supernatant is removed and the amount of residue determined by drying.
18	The SWeRF of the sample as determined by sedimentation is calculated using the above data [17] and [12].
19	The residue in the supernatant is calculated using the PSD [1], the density of the whole sample [5] and the time of sedimentation [16]. If the difference with SWeRFsed [18] is too large both methods of PSD and sedimentation should be investigated.
9&19	SWeRFcs (calc) [9] and SWeRFcs (Sed) [19] can be different. When this is the case a verification should be done. When the difference between [18] and [19] is small, this means that the CS does not have the same PSD as the

Sedimentation parameters		
Temperature of the liquid =	20.0	°C 10
Viscosity =	1.002	*1 g/m*s
Liquid Density =	998.2	3
Sample weight =	4.00	11
separated column =	0.10	m 12
Liquid column =	0.22	m

Determination of the SWeRFcs of the sample by sedimentation 13		
Time of sedimentation SWeRFcs	1:59	mm
Supernatant residue (density of CS)	0.350	g 14
CS in residue of the supernatant	15.0	%
SWeRFcs (sedimentation)	2.9	% 15

data entry cell

Verification:
When the size distribution and the sedimentation are correctly done, the difference between the calculated residue and residue recovered by sedimentation should be small. Please note that when density of the sample is different from the cryst. silica also the time of sedimentation is different.

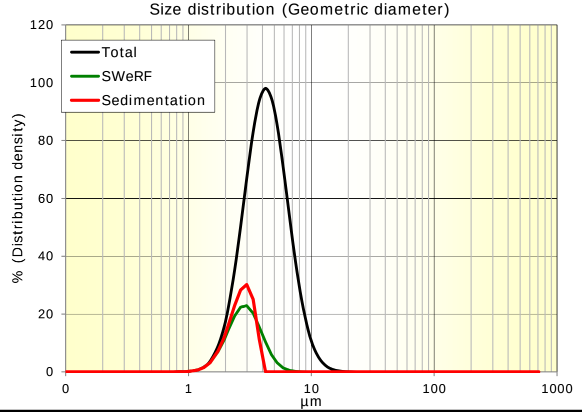
Comparison between sedimentation and calculated residue 16		
Time of sedimentation SWeRF	2:02	17
Supernatant residue (density of sample)	0.335	g
SWeRFsed =	**18.4**	18
Calc. residue in supernatant =	**18.1**	% 19

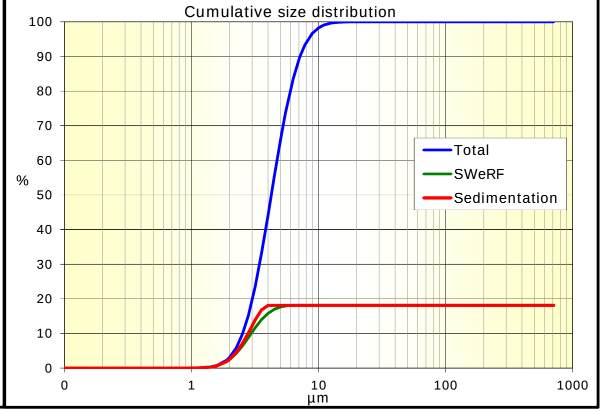
SWeRF	Sample name	Date: 24/04/2015	Sample			Cryst. Silica cont.	20.0	%
	Sample identification		Density =	2550	kg/m^3	CS Density =	2650	kg/m^3
			SWeRF =	18.2	%	$SWeRF_{cs}$ =	3.5	%

D_{50}	4.26	µm
Spec.Surface	0.60	m^2/g
Rel.span*	1.09	

your own results. Use only a cumulative size distribution.

Diameter (µm)	Cum. (%)
0.02	0.00
0.03	0.00
0.03	0.00
0.03	0.00
0.04	0.00
0.04	0.00
0.05	0.00
0.05	0.00
0.06	0.00
0.06	0.00
0.07	0.00
0.08	0.00
0.09	0.00
0.10	0.00
0.11	0.00
0.13	0.00
0.14	0.00
0.16	0.00
0.18	0.00
0.20	0.00
0.22	0.00
0.25	0.00
0.28	0.00
0.32	0.00
0.36	0.00
0.40	0.00
0.45	0.00
0.50	0.00
0.56	0.00
0.63	0.00
0.71	0.00
0.80	0.00
0.89	0.01
1.00	0.02





Sedimentation parameters		
Temperature of the liquid =	20.0	°C
Viscosity =	1.002	$*10^{-3}$ kg/m*s
Liquid Density =	998.2	kg/m^3
Sample weight =	4.00	g
separated column =	0.10	m
Liquid column =	0.22	m

Determination of the SWeRFcs of the sample by sedimentation		
Time of sedimentation SWeRFcs	1:59	uu:mm
Supernatant residue (density of CS)	0.350	g
CS in residue of the supernatant	15.0	%
SWeRFcs (sedimentation)	**2.9**	%

data entry cell

The black curve (Total) represents the density distribution of all the particles of the sample.	**The blue curve (Total) represents the cumulative size distribution of the sample.**
The green curve (SWeRF) represents the fine fraction in the sample as calculated according to EN 481.	**The green curve (SWeRF) represents the cumulative (size weighted) amount of fine fraction particles in the sample.**
The red curve (Sedimentation) represents the distribution of the particles that remain in the supernatant after sedimentation.	**The red curve (Sedimentation) represents the cumulative amount of the particles that remain in the supernatant after sedimentation.**

Verification:
When the size distribution and the sedimentation are correctly done, the difference between the calculated residue and residue recovered by sedimentation should be small. Please note that when density of the sample is different from the cryst. silica also the time of sedimentation is different.

Comparison between sedimentation and calculated residue		
Time of sedimentation SWeRF	2:02	uu:mm
Supernatant residue (density of sample)	0.335	g
$SWeRF_{sed}$ =	**18.4**	%
Calc. residue in supernatant =	**18.1**	%

Method of size distribution analysis:

Different methods will result in a different size distributions which consequently will result in different results for the SWeRF.
It is the responsibility of the user of this document to determine which method represents the sample the most accurately with regard to its behaviour in air. Use the same sample preparation method for determination of the size distribution as for the sedimentation.