Visitation of a mechanical reclamation unit for an inorganic binder system in Villingen-Schwenningen, on May 25-2012

Joint Project between
Technofond Gießereihilfsmittel GmbH,
Domnick Verfahrens- und Anlagentechnik and
AGVS Aluminium Werke GmbH Villingen

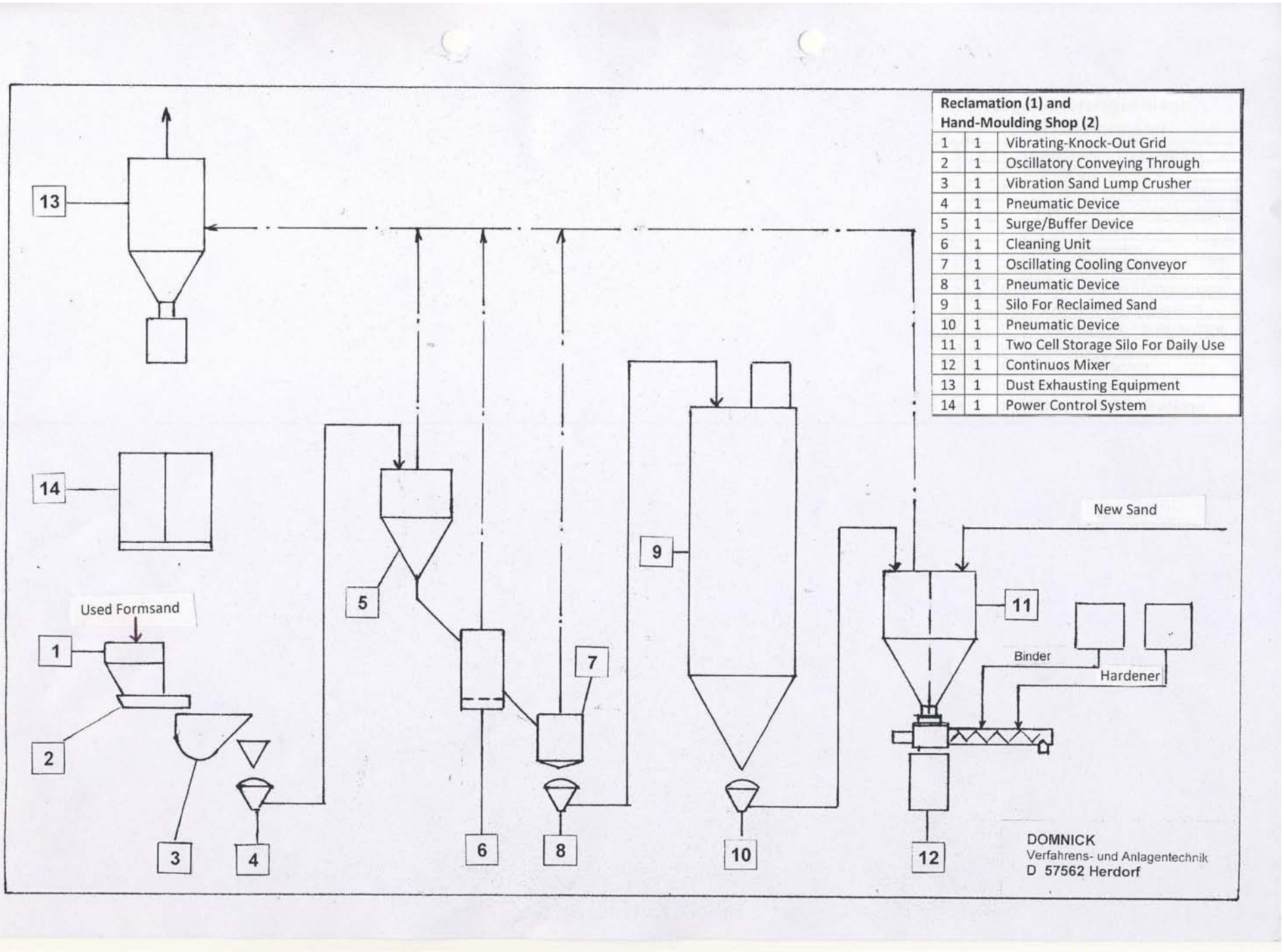
Process description of the mechanical reclamation unit for inorganic sand systems at AGVS Aluminium Werke GmbH Villingen

After the pouring process the used foundry sand is crushed in a vibratory sand lump crusher (3) and is set in it's originally shape.
In a buffer device (5) the used foundry sand is stored and is transferred batch-wise into the cleaning unit (6).
This cleaning unit consists of two agitators with several transversal agitation kits. The agitation kits are fitted on a shaft in various heights.
The agitators are moving against each other.
Below the cleaning unit (6) is a nozzle floor with an air box. This is used to move the sand constantly.
In the oscillating cooling conveyor (7) the sand is cooled to appropriate temperatures after the grinding process. The sand is removed from dust and conveyed to a hopper (9).

This process is running discontinuously.

During this mechanical cleaning process a significant share of the binder is removed from the sand grain.
The recycling of the sand for subsequent moulding requires that humidity and binder residues are removed, or existing only in a special condition, that the subsequent moulding process is not influenced in a negative way. This can be assured through the pilot unit at AGVS.

Note: The numbers shown are related to the position in the flow chart, next page.


Reclamation (1) and Hand-Moulding Shop (2)
1 1 Vibrating-Knock-Out Grid
2 1 Oscillatory Conveying Through
3 1 Vibration Sand Lump Crusher
4 1 Pneumatic Device
5 1 Surge/Buffer Device
6 1 Cleaning Unit
7 1 Oscillating Cooling Conveyor
8 1 Pneumatic Device
9 1 Silo For Reclaimed Sand
10 1 Pneumatic Device
11 1 Two Cell Storage Silo For Daily Use
12 1 Continuos Mixer
13 1 Dust Exhausting Equipment
14 1 Power Control System
Used Formsand
New Sand
Binder
Hardener
DOMNICK
Verfahrens- und Anlagentechnik
D 57562 Herdorf

Pictures of the reclamation unit

Table of Figures showing the reclamation unit:

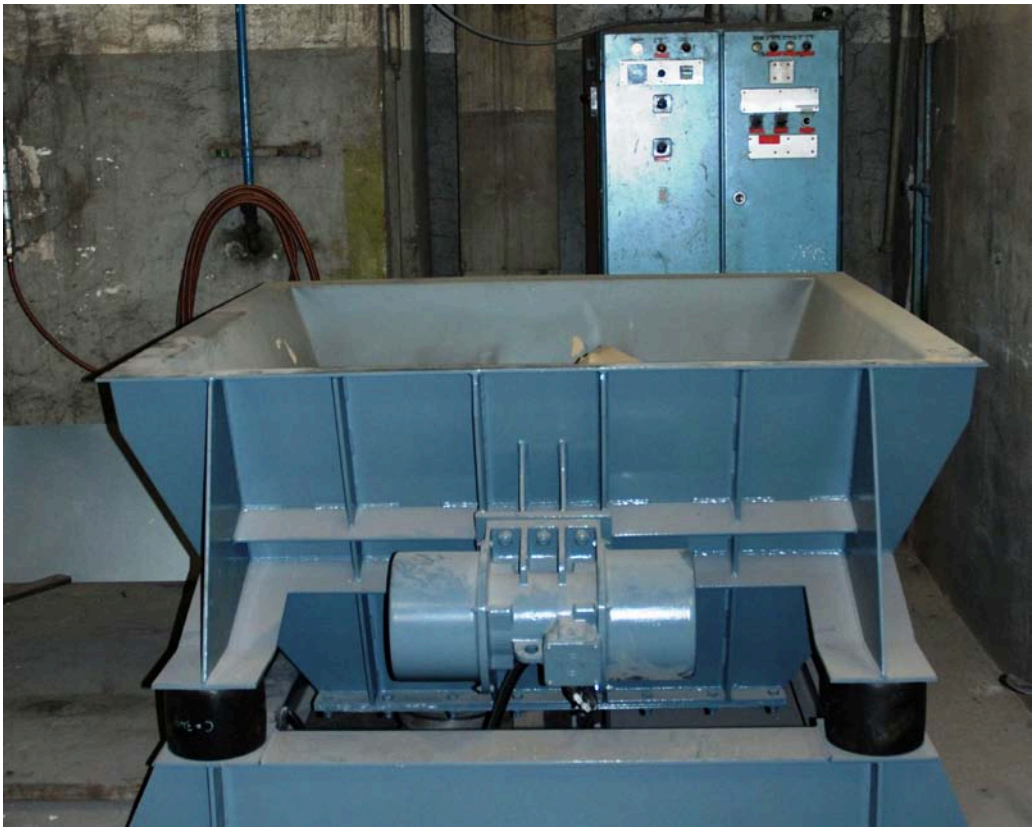


Fig. 1 Vibrating sand lump crusher (3)

Fig.2 Vibrating sand lump crusher (3) with cast sand moulds

Fig.3 Bottom of the crusher

Fig. 4 Surge device (5 top left) and cleaning unit (6)

Fig. 5 cleaning unit (6) with oscillating cooling conveyor (7) on right hand side

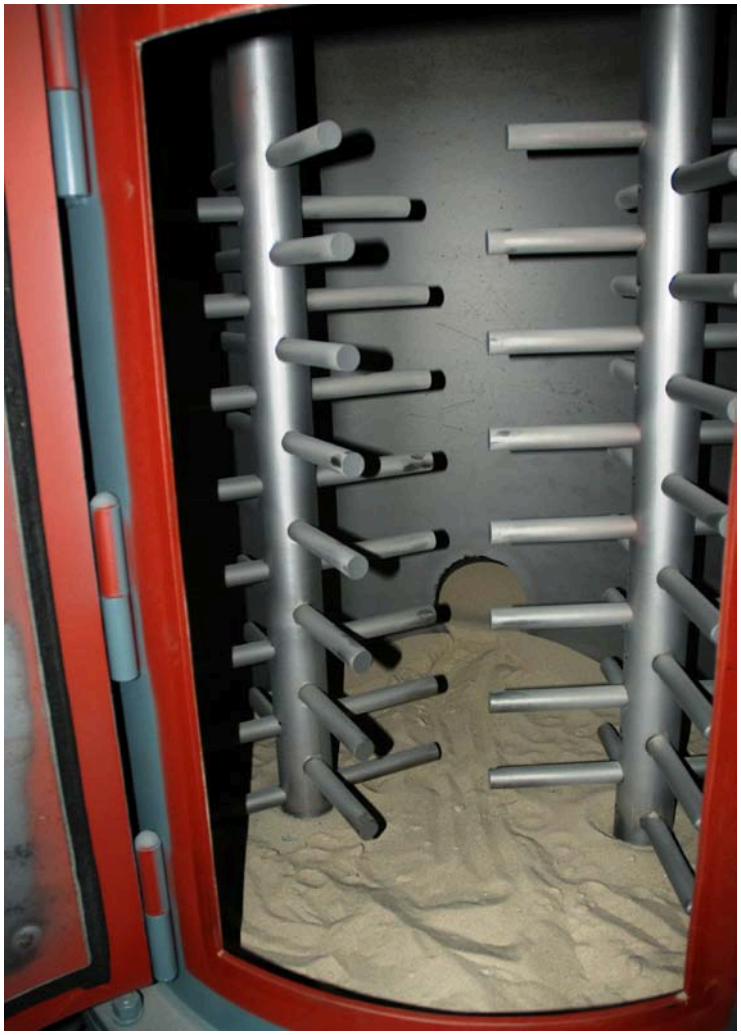


Fig. 6 Interior of cleaning unit (6) with new agitation kits

Fig. 7 cleaning unit (6); Nozzle floor with used agitation kits

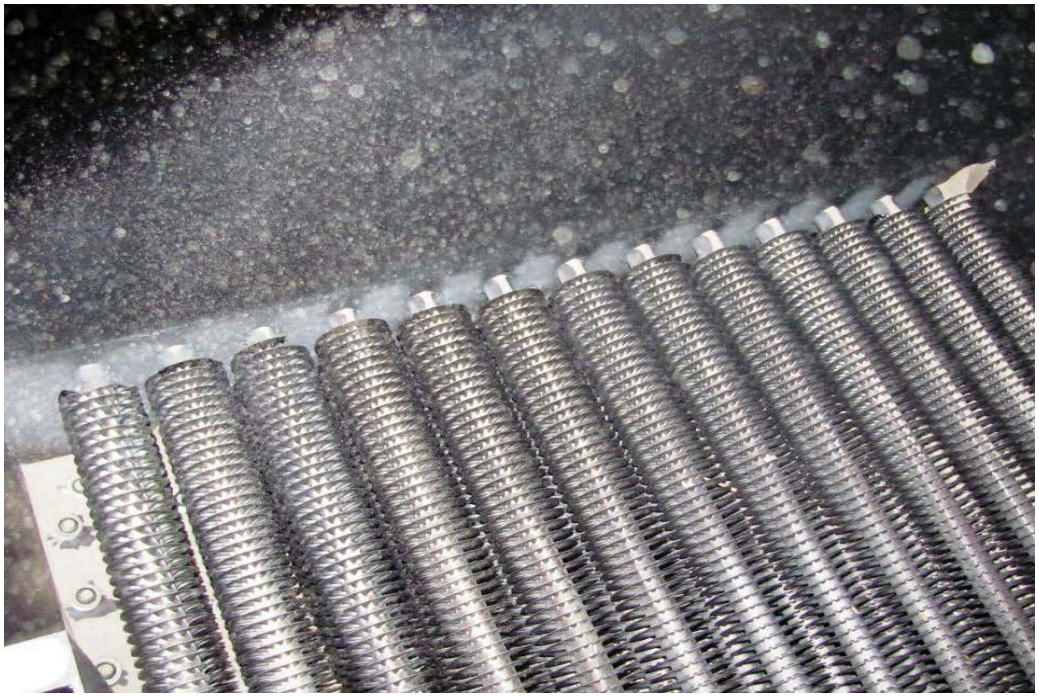


Fig. 8 Oscillating Cooling Conveyor (7) from inside

Fig. 9 Oscillating Cooling Conveyor (7 on top) with Sender

Fig. 10 Dust Exhausting Equipment (13)

Sand Grains

List of Figures from Microscopy:

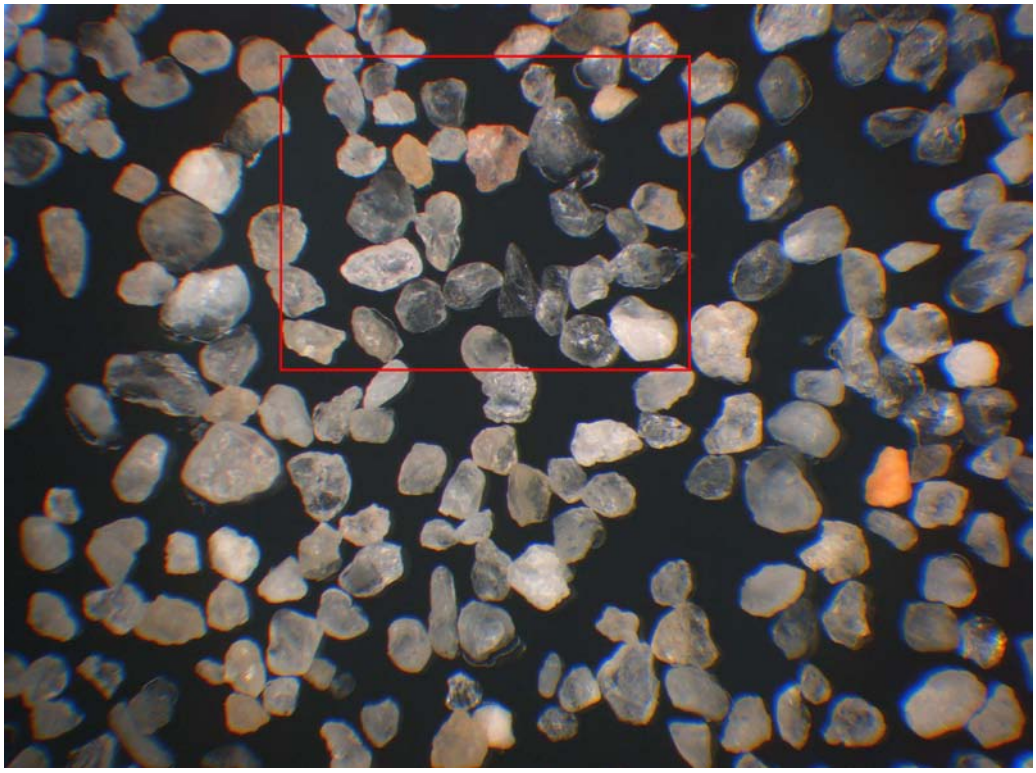


Fig. 1 H33; Stereomicroscopy; Magnification 16:1

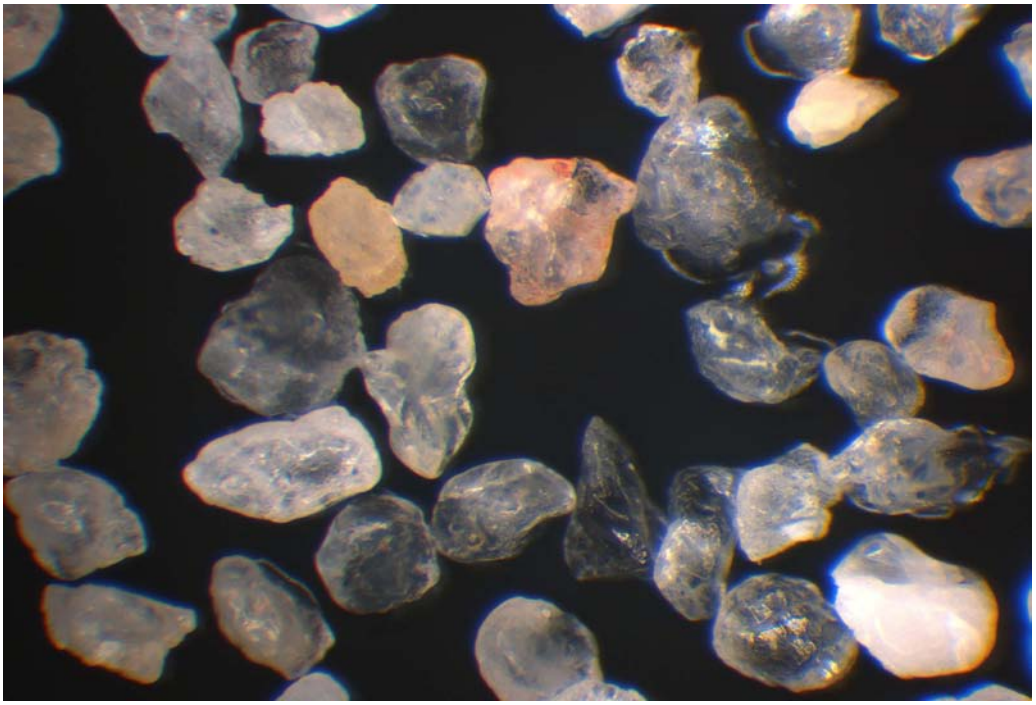


Fig. 2 H33; Stereomicroscopy; Magnification 40:1

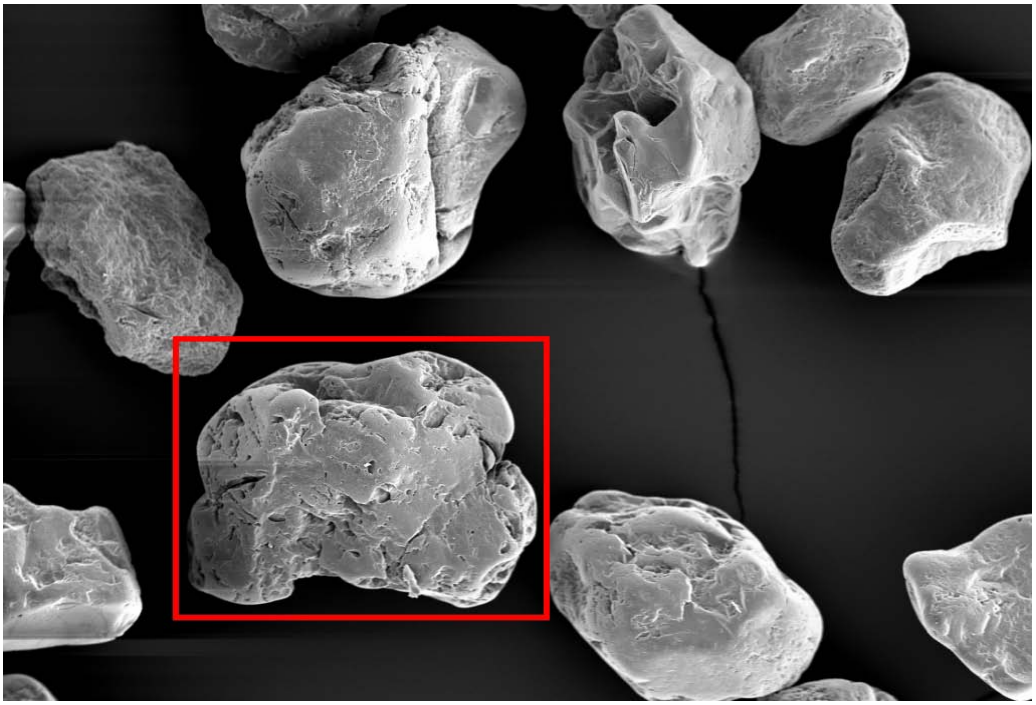


Fig. 3 H33; REM-Microscopy; Magnification 70:1

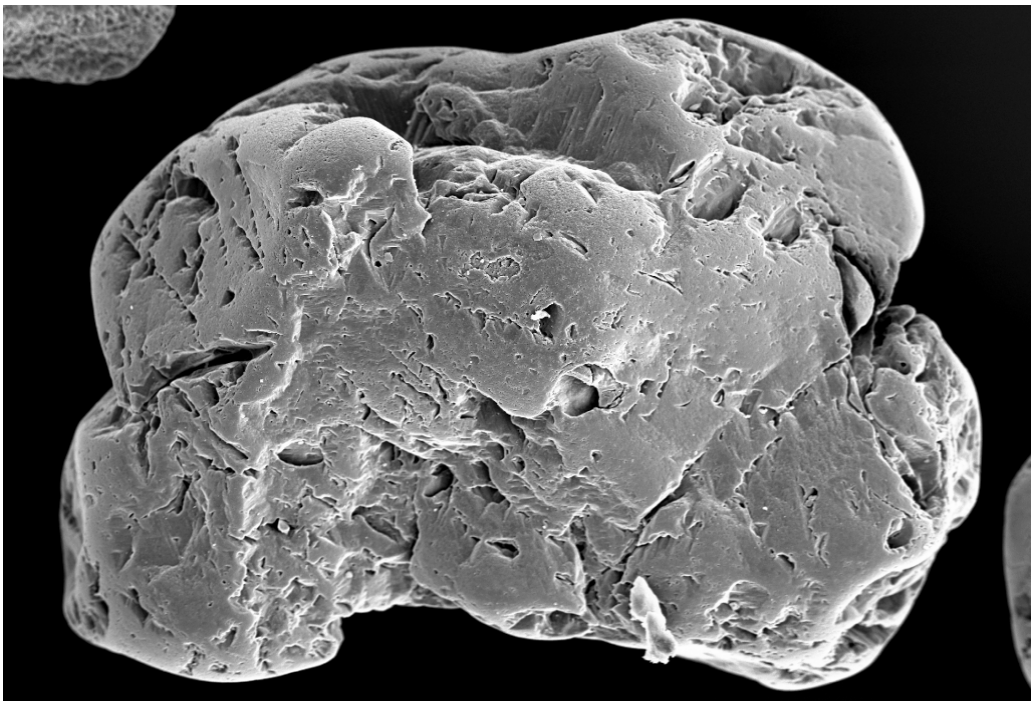


Fig. 4 H33; REM-Microscopy; Magnification 185:1

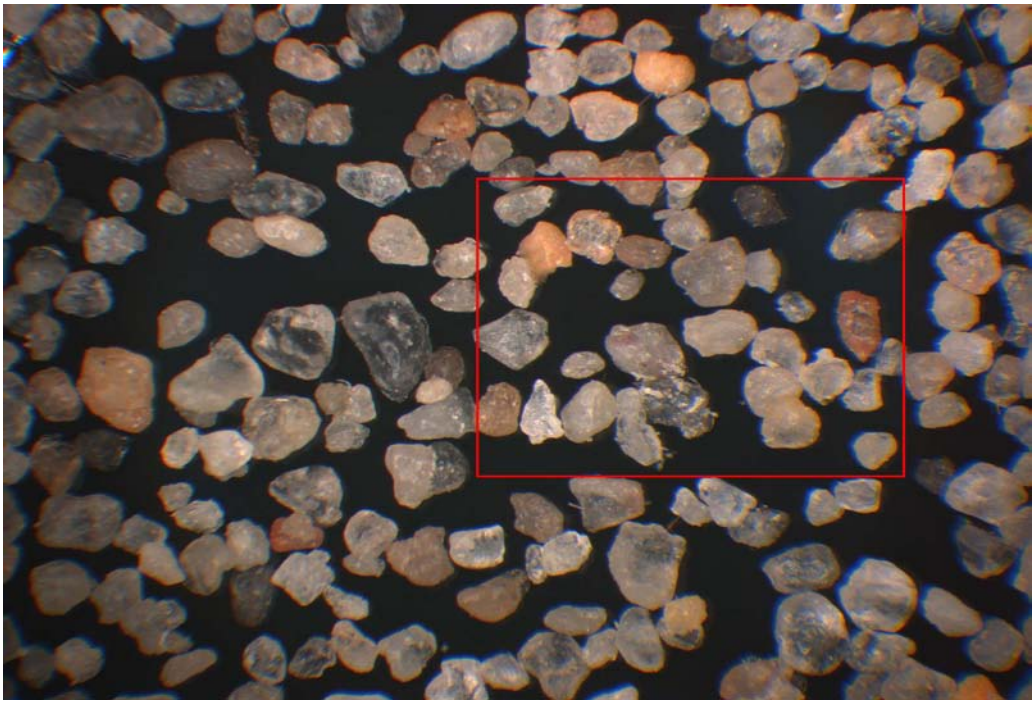


Fig. 5 Reclaimed sand from surge device (5); Stereomicroscopy; Magnification 16:1

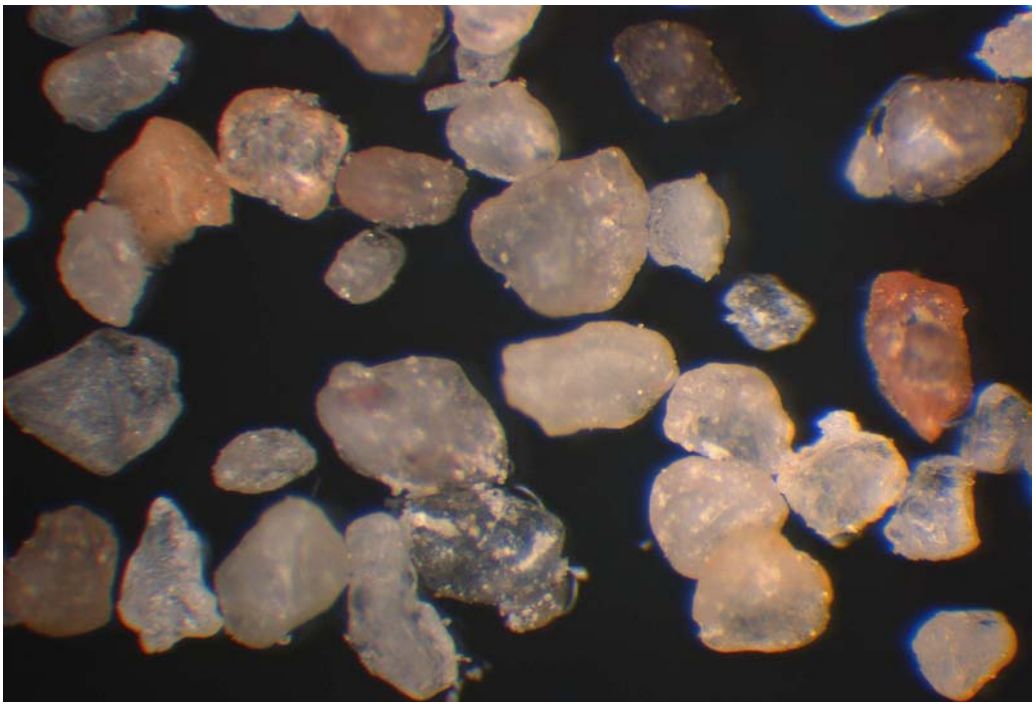


Fig. 6 Reclaimed sand from surge device (5); Stereomicroscopy; Magnification 40:1

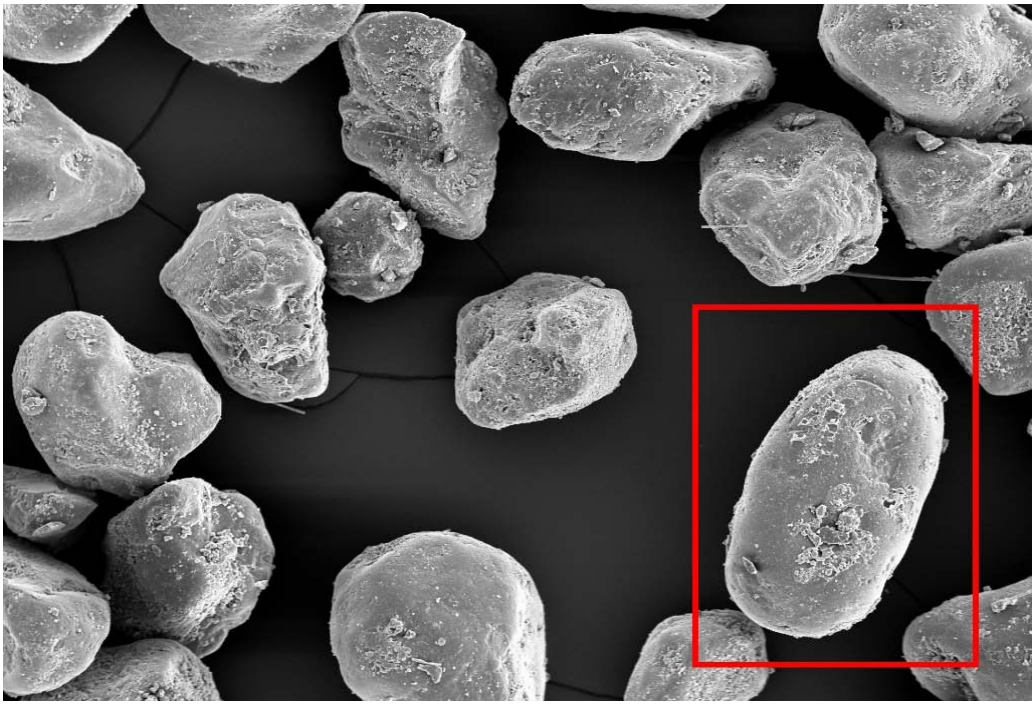


Fig. 7 Reclaimed sand from surge device (5); REM-Microscopy; magnification 65:1

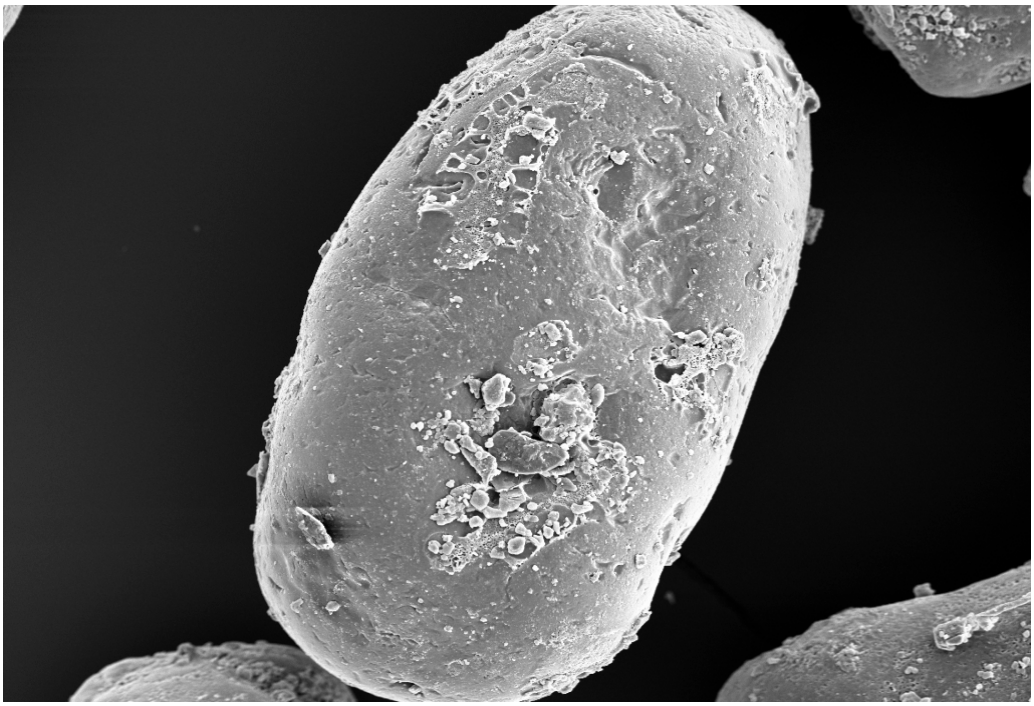


Fig. 8 Reclaimed sand from surge device (5); REM-Microscopy; Magnification 160:1

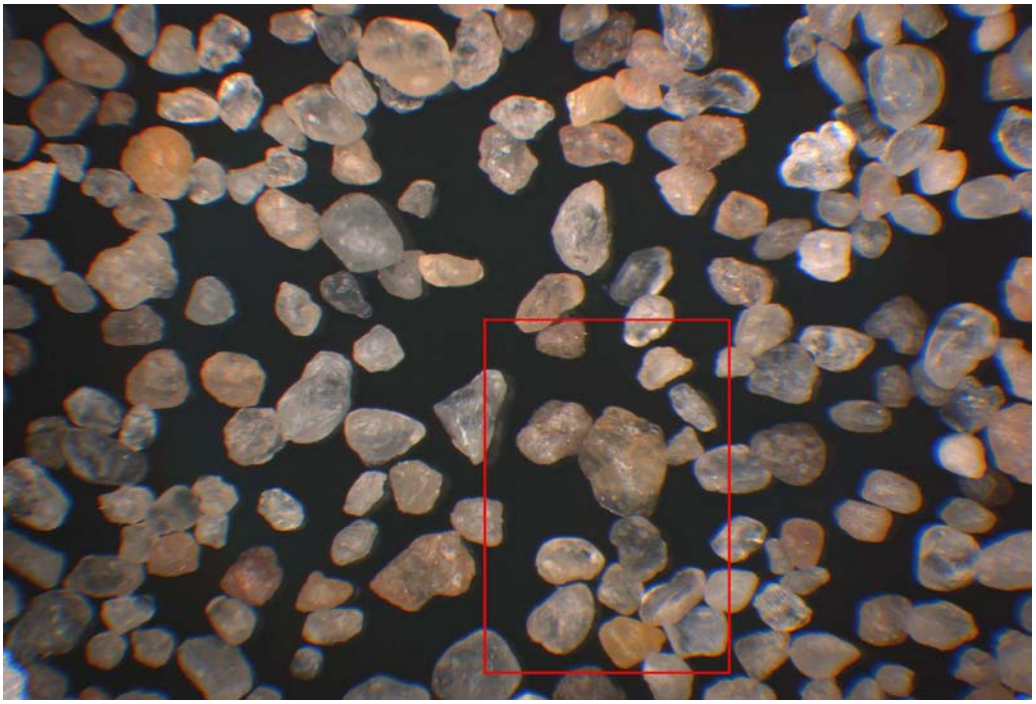


Fig. 9 Reclaimed sand from Two-Cell storage Silo (11); Stereomicroscopy; Magnification 16:1

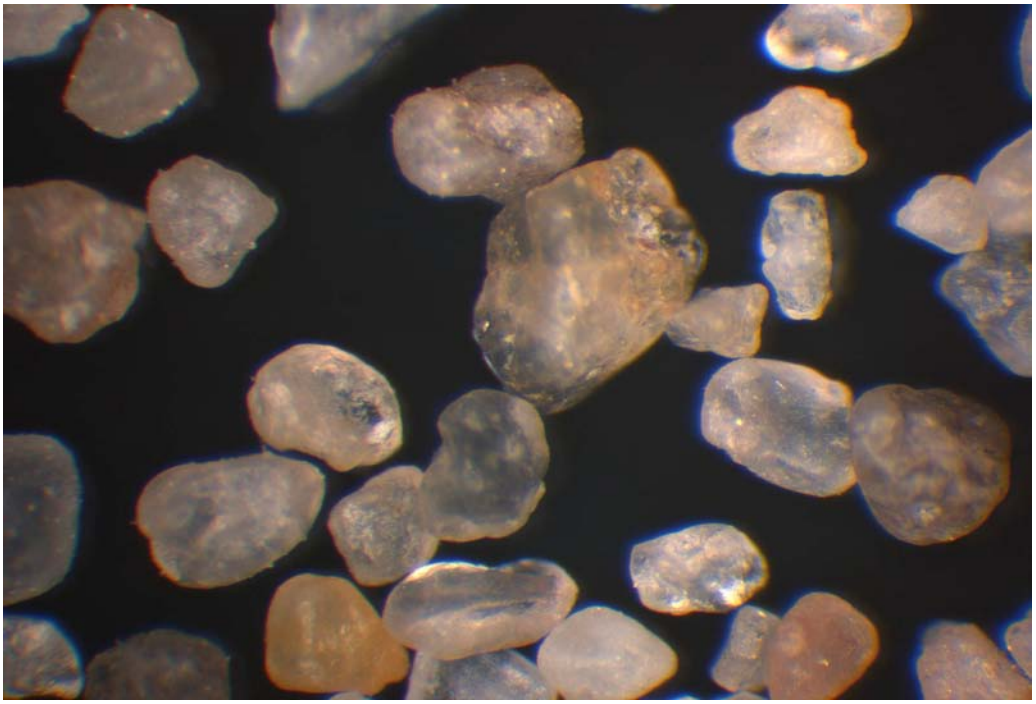


Fig.10 Reclaimed sand from Two-Cell storage Silo (11); Stereomicroscopy; Magnification 40:1

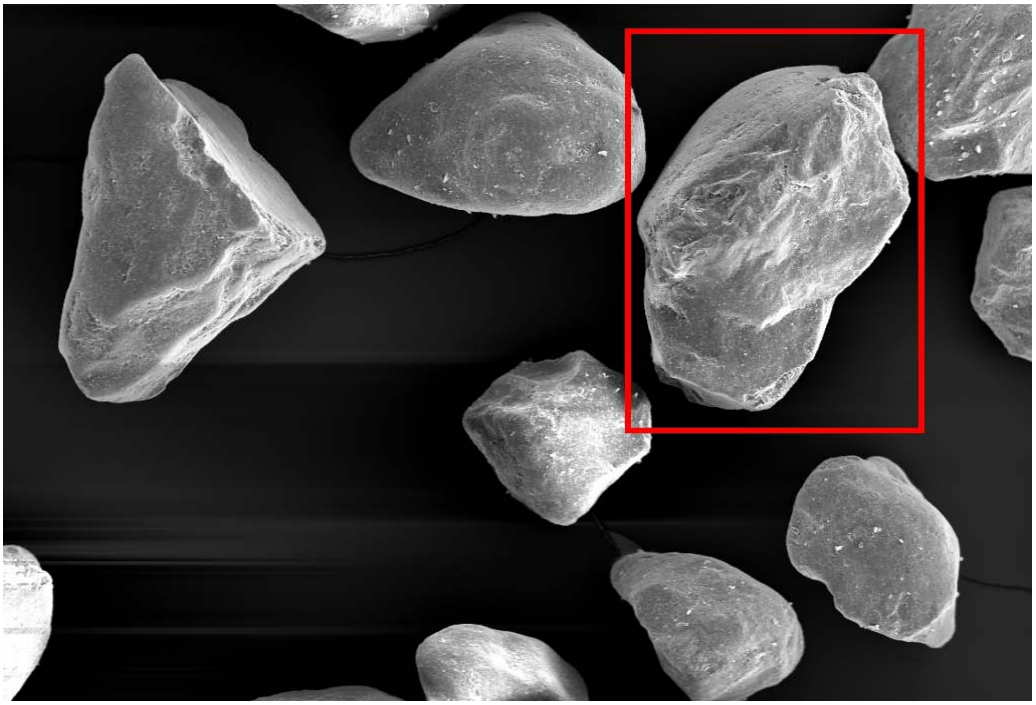


Fig.11 Reclaimed sand from Two-Cell storage Silo (11); REM- Microscopy; Magnification 60:1

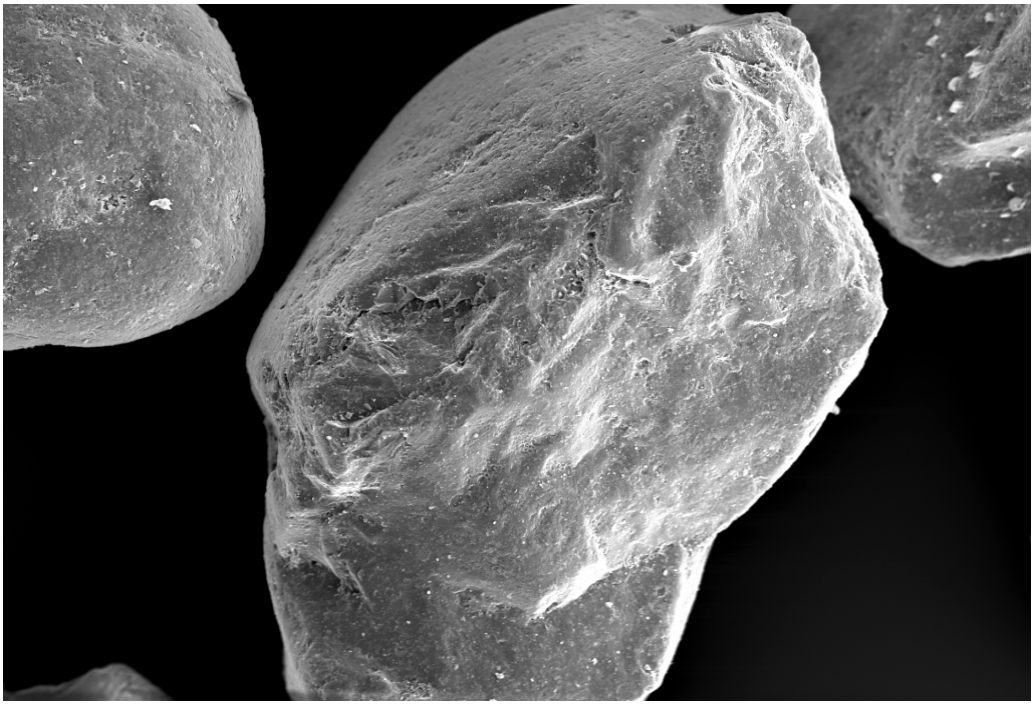


Fig.12 Reclaimed sand from Two-Cell storage Silo (11); REM- Microscopy; Magnification 140:1

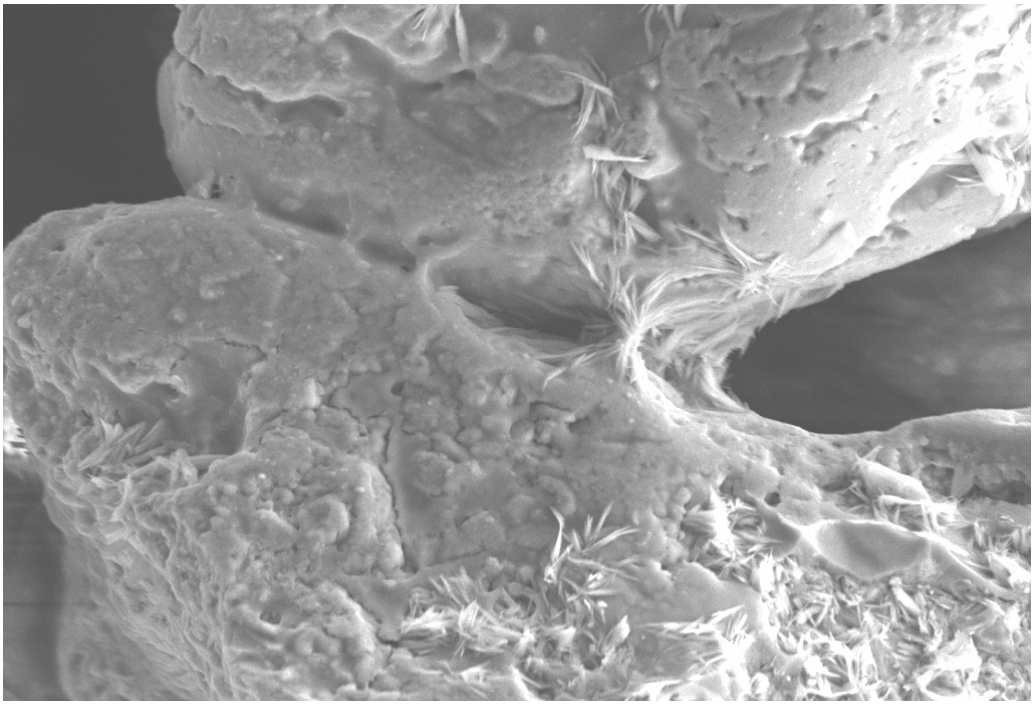


Fig. 13 Binder Bridges on H33; REM-Microscopy, Magnification 810:1

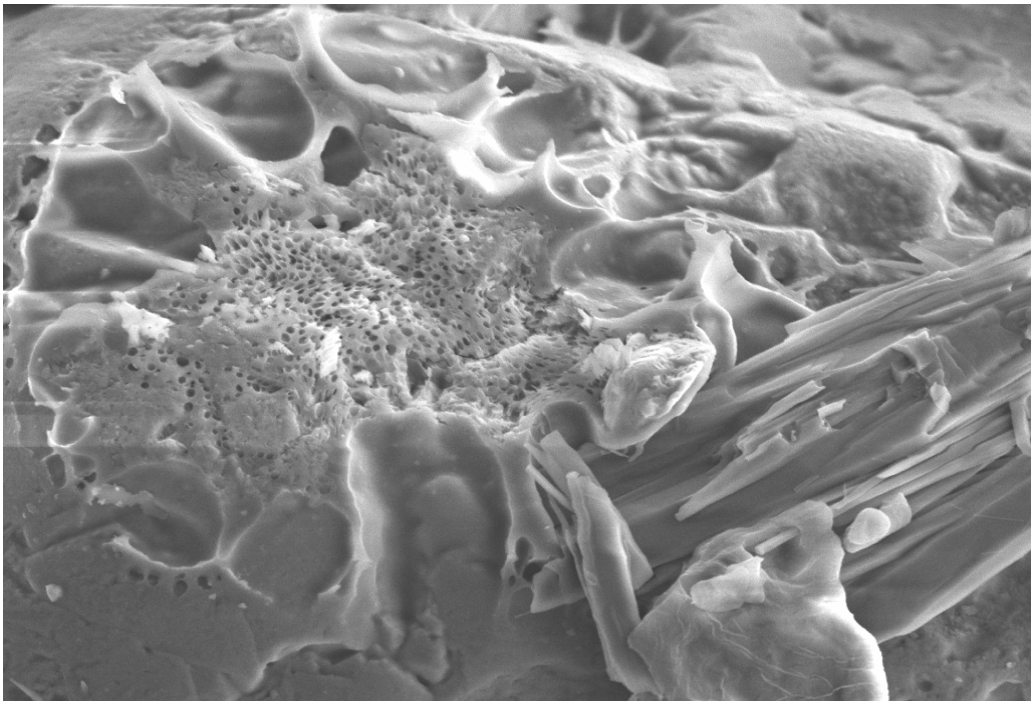


Fig. 14 Binder Bridges; Geopolymerbinder on H33; REM-Microscopy; Magnification 860:1

Diagrams

List of Figures for Diagrams related to sand properties:

Granulometric Analyse

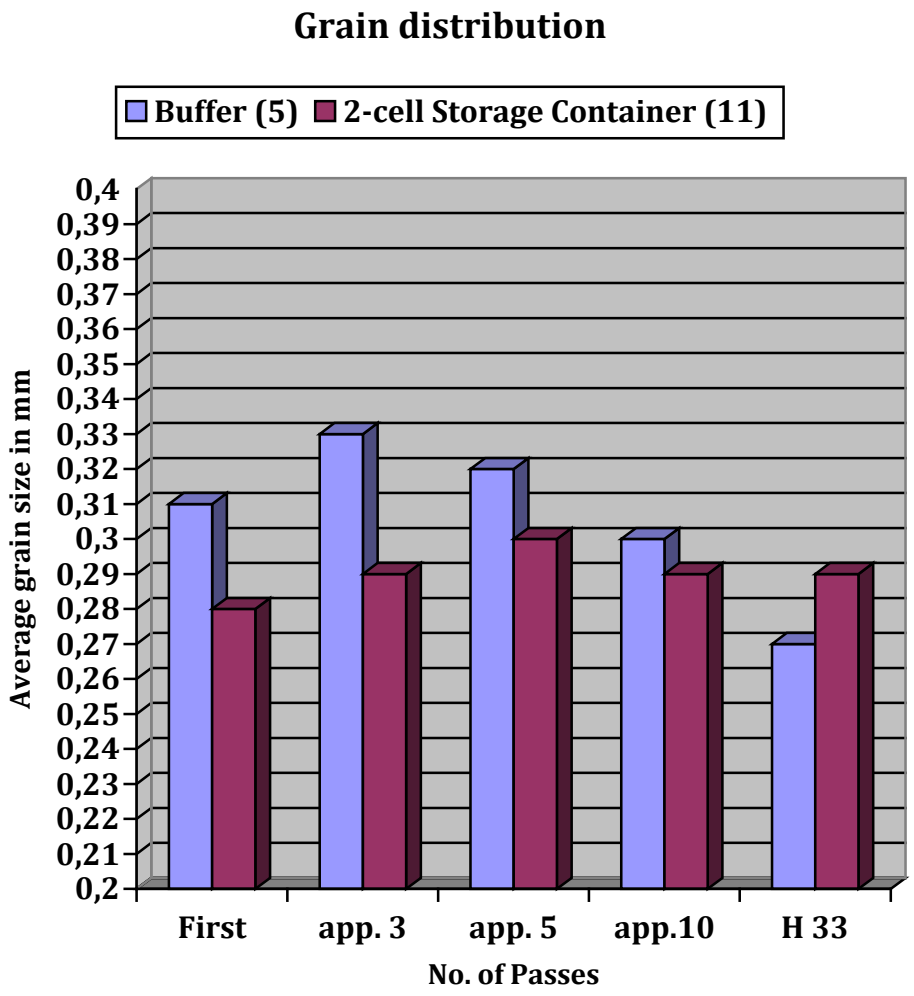


Fig1: Grain Distribution related to different Nos. of passes through reclamation.

For H33 new sand the actual Product information Value for average grain size is shown (0,27 mm) and the value measured after the continuous mixer. There are only negligible deviations of the values achieved by reclaimed sand. Started autumn 2010 until present the average grain size was always near 0,29 mm.
In the surge device (5) before grinding the average grain size is up to 0,04 mm higher.

The total Sand and dust loss in 2011 was app. 7 %, always keeping in mind, that during this time scale many trials with test parameters for the reclamation unit were carried out.

Strength and Reactivity

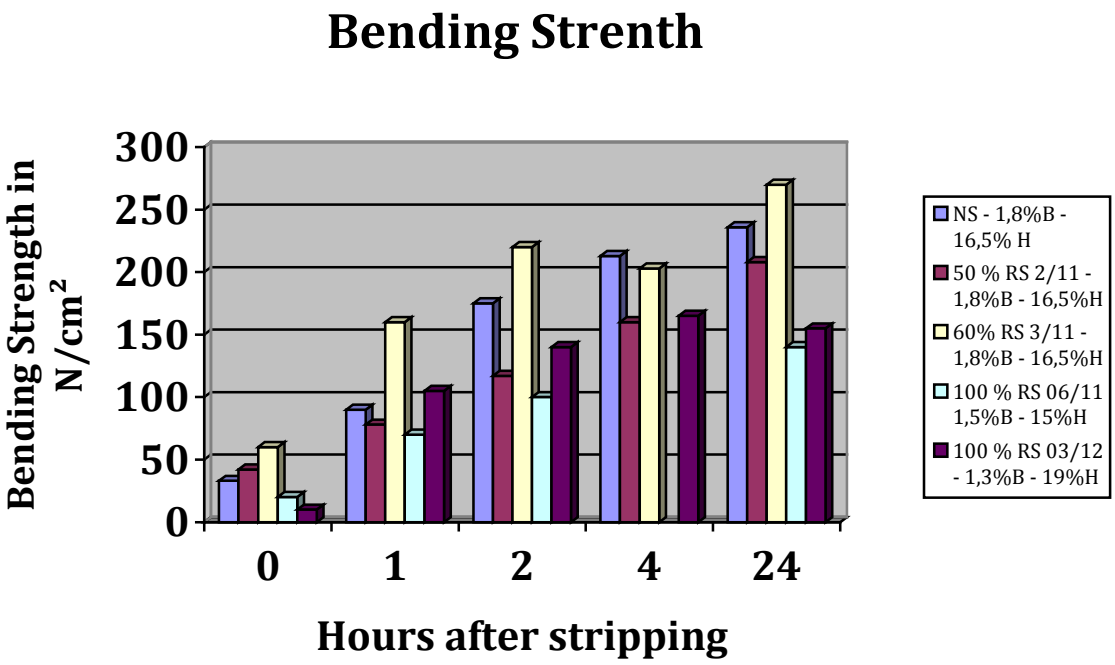


Fig.2: Bending Strength of various sand mixtures with Hardener SA73-T and Binder Geopol® 515.

The binder and hardener addition was reduced significantly during production.
All values shown were made with a GF Bend Test Piece.
Minimum of three measures per value shown were done.
The actual weight of the test piece was measured and was compared to average weight of all values.
A maximum deviation of 3 % was allowed.
Mixer was a 6,0 t continuous mixer from Wöhr. Stripping Time was 1 hour for all test-samples.

Legend: NS-New Sand, RS-reclaimed sand, B-Binder, H-Hardener, 2/11 - month and year of test.

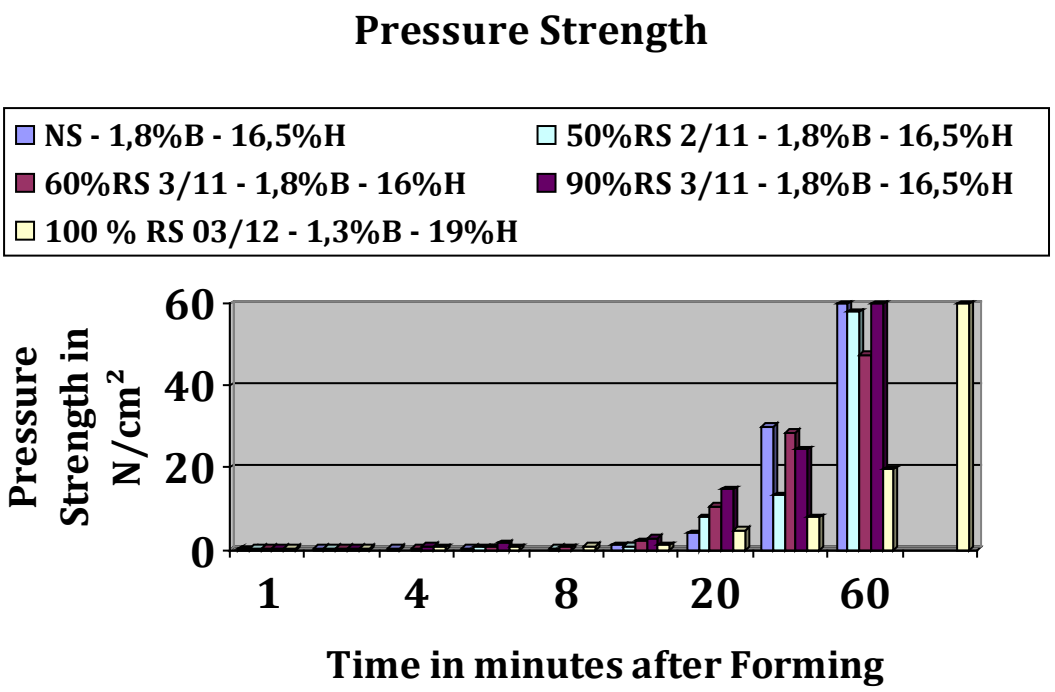


Fig.3: Pressure Strength tested with the "PFP" from DISA

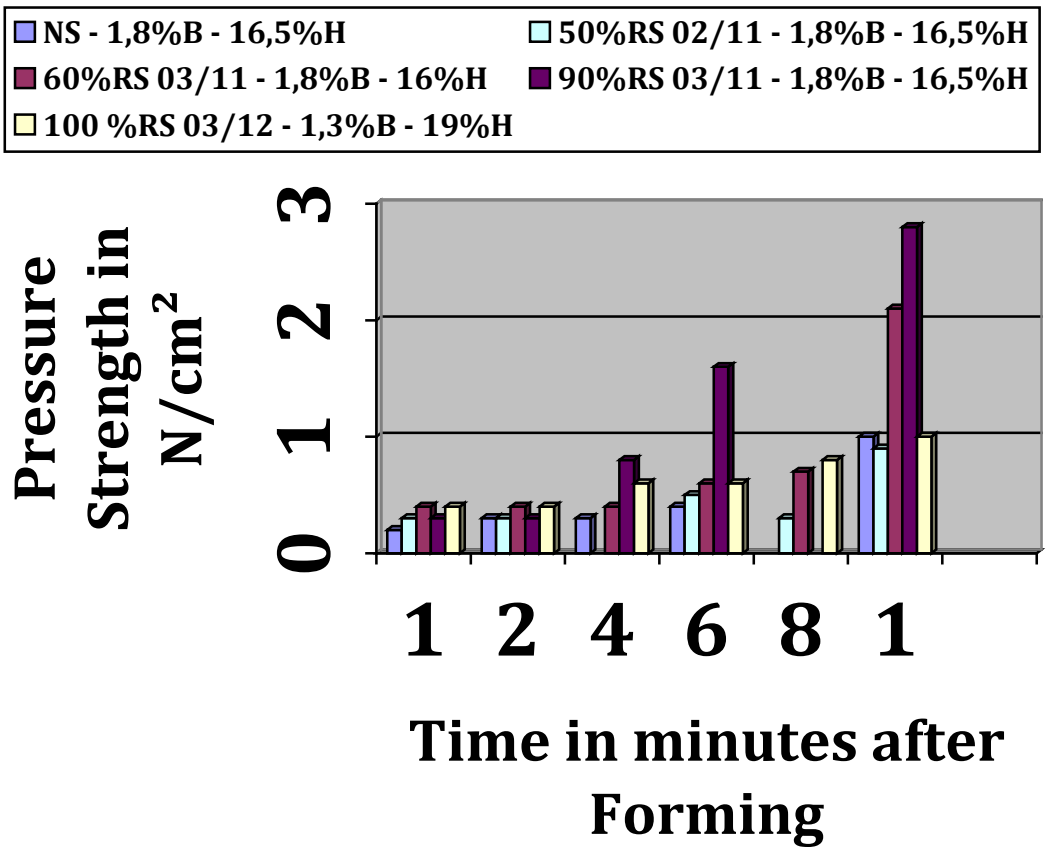


Fig.4: Detailed Pressure Strength from Fig. 3 tested with the "PFP" from DISA.

The pressure Strength graphs shows the reactivity of the sand and is influenced by residuals remaining in the sand.
It is considered as a good practical check to determine bench life of the sand. From experienced datas we know that the pressure strength should not be far above 1,0 N/cm². If the sand is manipulated above this value of 1,0 the binder bridges are affected and the end strength is depressed.

Other significant values for assessment of the reclaimed sand are the Electrical Conductivity (recommended limit < 800 µS) and Sodium content (recommended in literture < 0,20%).
Measured values for electrical conductivity are below 500 µS and for the sodium from 0,05 % to around 0,3 %.

All values shown, measurements and sampling were done out during normal production routine at AGVS.

ZIM
impulse für wachstum
Zentrales Innovationsprogramm Mittelstand

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