

Utilization of bio-mass ashes as sliding material

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Preparation of abrasives

- Matrix: industrially prepared clay material (MK-750), waste raw material (shistous clay), blast furnace slag (BFS)
- Sliding material: bio-mass ash (wood ash, corn straw ash)
- Additives: SiC grains, corundum, marble, stone powder, etc.
- Particle size and type of additives: according to purposes – grinding/polishing

Thermally treated material: Schistous clay

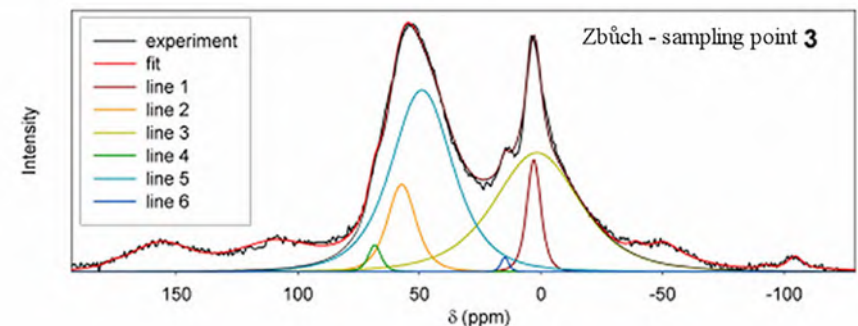
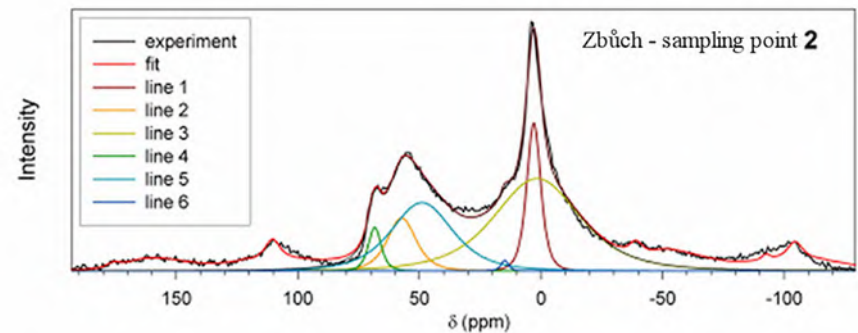
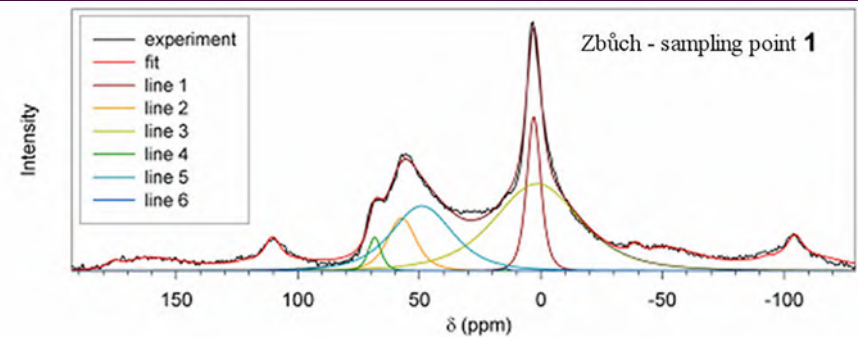
- Zbůch (West Bohemia region), only 45 wt.% of clayed mineral
- Dumps of over layered material-coal mining
- Containing a proportion of coal
- Delayed burning (50 years)



Thermally treated material: Schistous clay

- Naturally long-term burning processes – thermal transformation
- ^{27}Al MAS NMR in solid state:

Sampling point	[4] Al^{3+}	[6] Al^{3+}
1	38.0%	62.0%
2	38.3%	61.7%
3	45.9%	54.1%



Materials

Material/ Oxide (wt.%)	SiO ₂	Al ₂ O ₃	CaO	SO ₃	K ₂ O	Fe ₂ O ₃	LOI
Shistous clay	55.07	34.46	0.51	0.25	1.74	3.85	2.00
MK-750	52.90	41.90	0.13	0.02	0.77	1.08	0.10
Blast furnace slag	22.38	8.01	37.44	7.47	1.27	2.31	14.7
Wooden ash	56.12	10.59	14.17	0.06	5.55	8.47	0.1
Corn straw ash	56.54	2.43	7.89	0.30	19.06	1.50	5.30

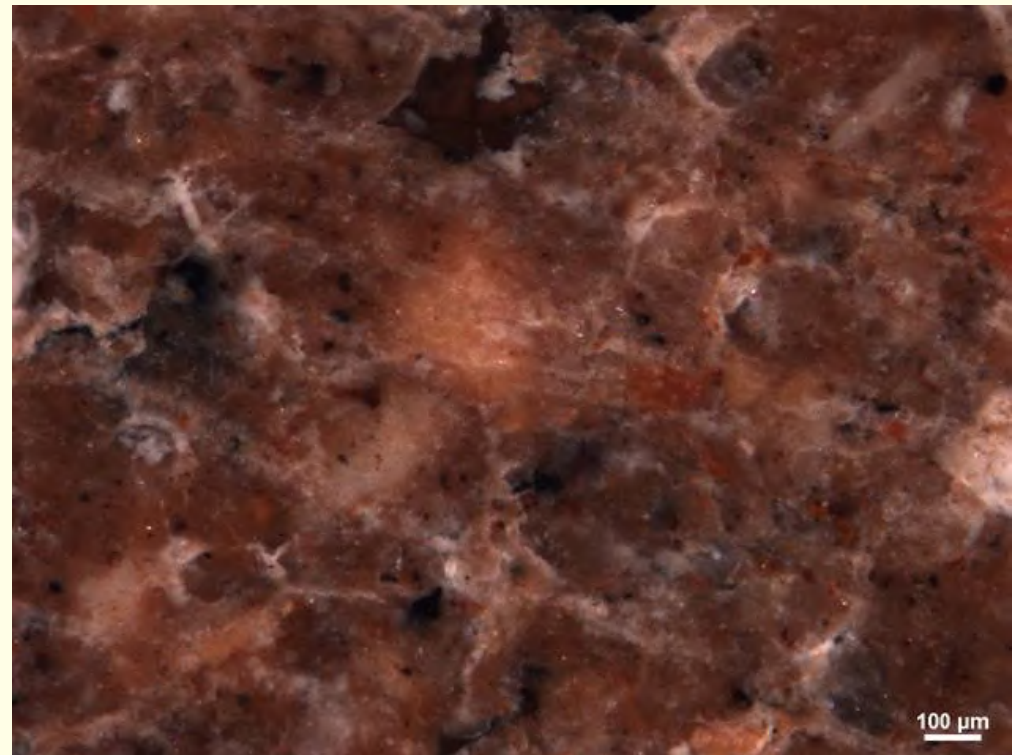
Hand grinding

Matrix:

Schistous clay (Zbüch town)

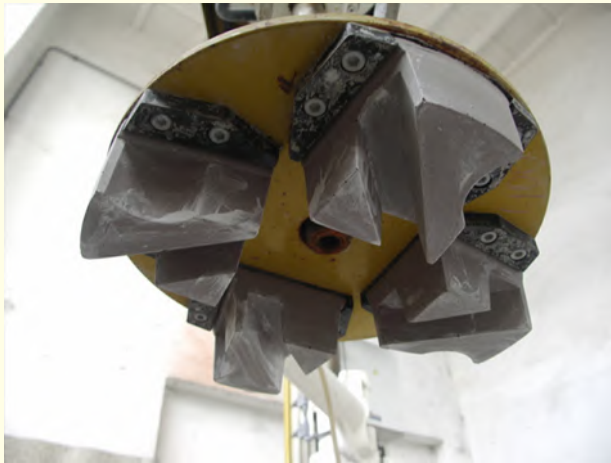
Abrasives: brown corundum F36 (25 wt.%)

Sliding material: wood ash (5 wt.%)



Semi-industrial grinding and polishing

- Matrix: mixture of industrially prepared primary clay material and blast furnace slag (1 : 1.8)
- Abrasives: brown corundum F36 (26 wt.%)
- Sliding material: corn straw ash (5 wt.%)



Grinding stones fixed in holder

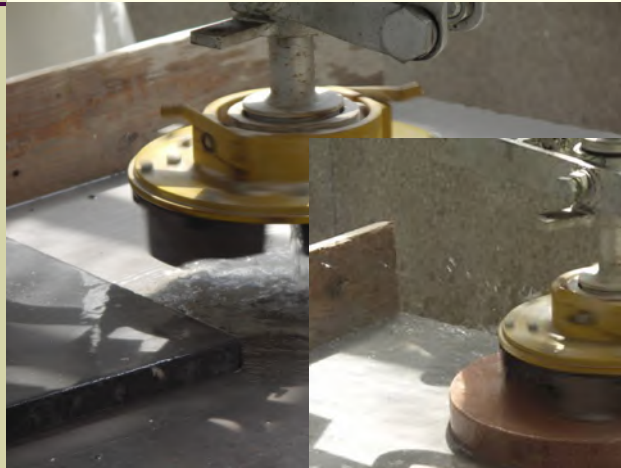


Grinding/polishing machine – general view



Machine prepared for grinding

Semi-industrial grinding and polishing



Wet grinding



Creating of plane surface



General view on grinding process



Turning motion of grinding stones

Semi-industrial grinding and polishing



Grinding stones after grinding



Detailed view on grinding stones after grinding

Waste materials:

■ Advantages:

- Low costs material
- The ecological aspects (cleanup of old industrial brown fields and dumps)
- Utilization of different local materials (slag, ash, etc.)

■ Disadvantages:

- Non-constant chemical composition – necessity of testing
- Non-constant particle size – necessity of milling, separating and granulometric analysis
- The efflorescence
- Lower mechanical properties
- Lower filling by additives

Industrially prepared raw materials

■ Advantages:

- Guaranteed chemical composition
- Guaranteed particle size
- High finesse of particles
- No mechanical or thermal treatments
- Use of lower amount to make a resulting material (content of clay mineral – 100 %)
- Lower risk of efflorescence
- Staff, time and energy saving

■ Disadvantages:

- Higher material costs
- Transport charges

Possibilities:

1. Use of waste material for matrix
 - Lower filling by different additives
 - Utilization for specific application
2. Use of industrially prepared primary material for matrix
 - Filling by different additives – up to 90 wt.%
 - Sandstone – desert sand, sand with higher content of undesirable oxides (Fe, Ti, etc.)
3. Use a combination of primary and waste raw material (from 1:1 to 1:2) to make a matrix
 - Waste raw material: slag, ash, schistous clay
 - Filling by different additives

Conclusion

- Mentioned material source (schistous clay) could be used as main, 3D net forming, substance
- Bio-mass ash could be used as sliding materials in abrasives
- Prepared abrasive materials were successfully tested with positive results
- Any type of treatment means increasing costs and is one of the limitation factors.
- The economic factors play very important role in case of industrial production.



THANK YOU FOR YOUR
ATTENTION

