STRATEGIE AV21

GIG Research Institute

INNOWACYJNE PRODUKTY DLA GÓRNICTWA I INŻYNIERII LĄDOWEJ Z MATERIAŁÓW NA BAZIE ODPADÓW GÓRNICZYCH. (INOVATIVNÍ PRODUKTY PRO HORNICTVÍ A STAVEBNICTVÍ Z MATERIÁLŮ NA BÁZI TĚŽEBNÍHO ODPADU.)

Research Fund for Coal & Steel

10.-11. 5. 2023

"Górnictwo w XXI wieku"

...i co jeszcze...?

ZBIGNIEW LUBOSIK
AGNIESZKA KLUPA
ALEKSANDER WRANA
Główny Instytut Górnictwa

Plan prezentacji

a) Gospodarka obiegu zamkniętego w górnictwie;

Gospodarka o obiegu zamkniętym to model produkcji i konsumpcji, który polega na dzieleniu się, pożyczaniu, ponownym użyciu, naprawie, odnawianiu i recyklingu istniejących materiałów i produktów tak długo, jak to możliwe.

b) Produkty dla górnictwa w polimetobetonu z dodatkiem odpdaów górniczych

Polimerobeton zaliczany jest do materiałów kompozytowych ceramiczno-polimerowych. Polimerobetony to produkty w których jako lepiszcze stosowane są sysntetyczne żywice chemoutwardzalne (poliestrowe, poliuretanowe, epoksydowe i inne). Pozostały skład to kruszywo.

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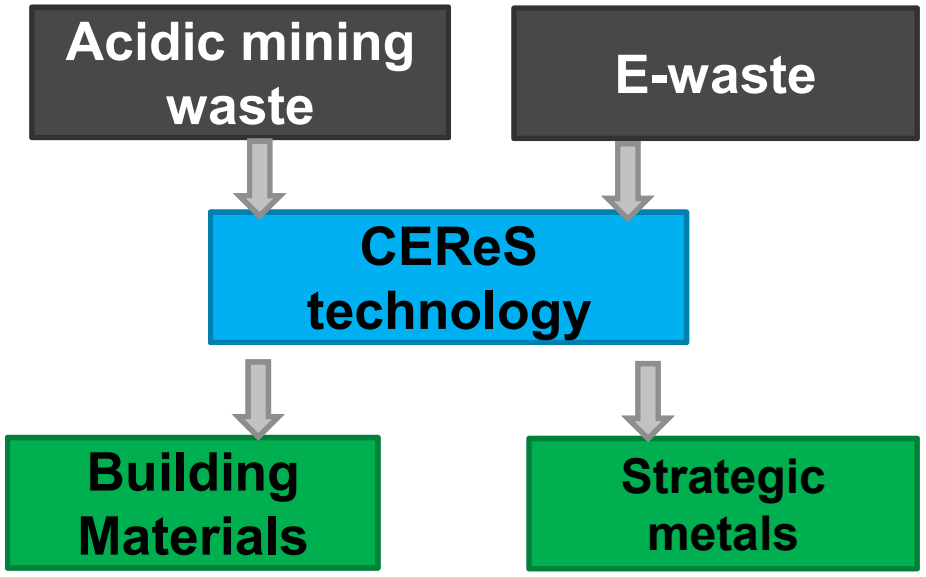
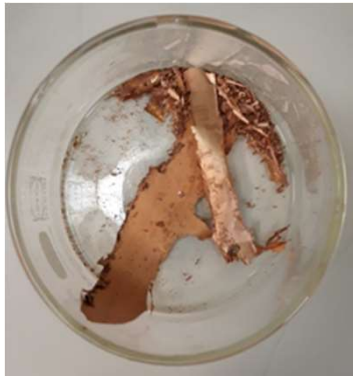
CO-PROCESSING OF COAL MINE AND ELECTRONIC: NOVEL RESOURCES FOR A SUSTAINABLE FUTURE

The aim of the **CERES** project was to process post-mining and electronic waste in order to recover metals and obtain valuable products based on stabilized waste, eliminating their negative impact on the environment.





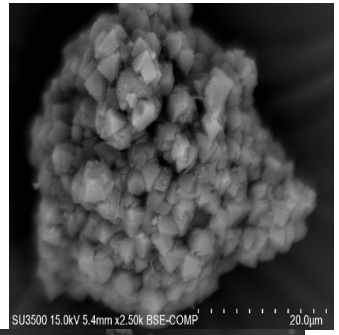
Project consortium: the United Kingdom, Poland, France and Belgium
The CERES project received funding from the European Union under the RFCS Grant Agreement no. 709868
Implementation period: 2016-2019

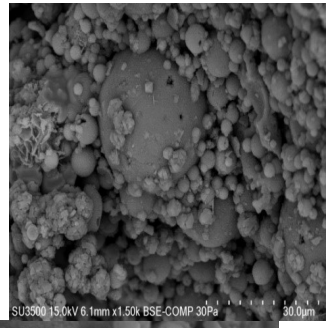
INNOVATIVE MANAGEMENT OF COAL BY-PRODUCTS LEADING ALSO TO CO_2 EMISSIONS REDUCTION

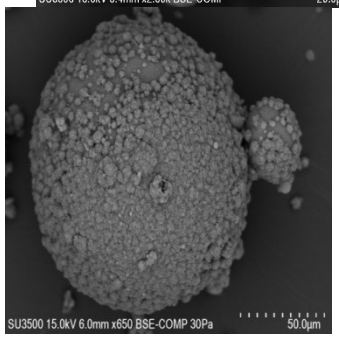
The **COALBYPRO** project aimed to reduce CO_2 emissions using innovative methods of managing coal combustion by-products.

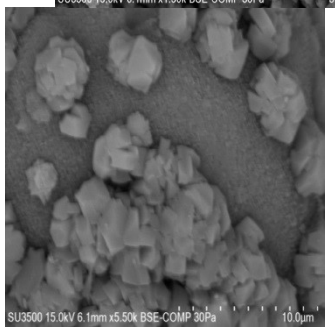
The primary utilitarian goal of the **COALBYPRO** project was the sequestration of CO_2 in fly ash and zeolites produced from it, and the management of the products obtained in this way.

- Characterisation of coal fly ash generated from different European power plants
- CO_2 capture in coal fly ash
- Application of zeolites for CO_2 capture
- Application of the products after CO_2 capture









Project consortium: Greece, Poland, the Czech Republic, Germany. The COALBYPRO project received funding from the European Union under the RFCS Grant Agreement no. 754060 and Ministry of Education and Science (Agreement No. 3935/FBWiS/2018/2)
Implementation period: 2017-2020

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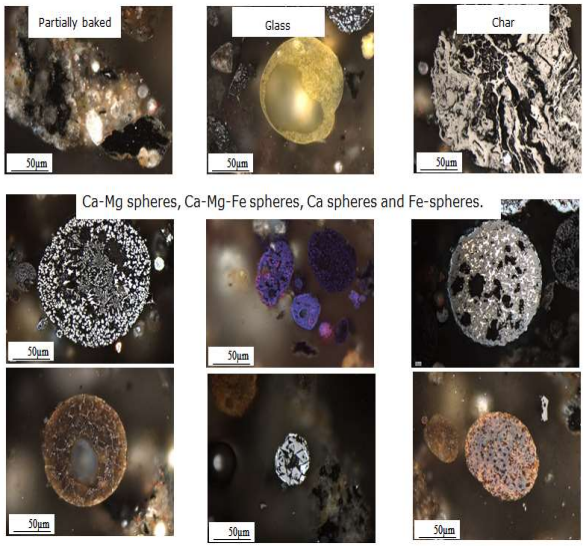
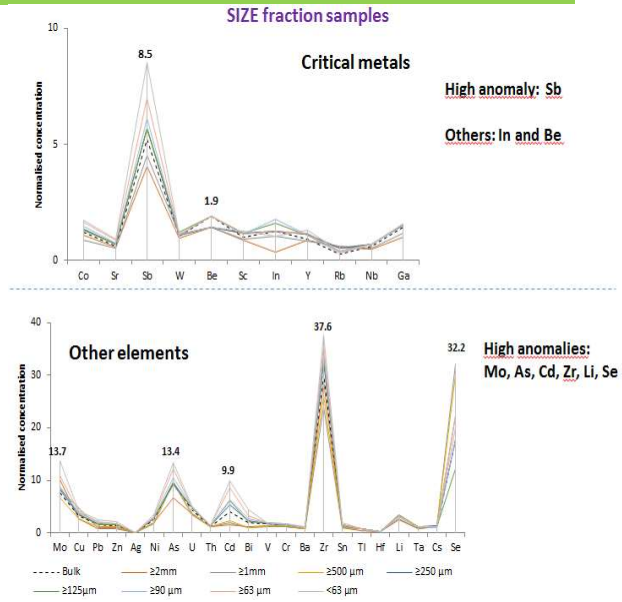
RAREASH

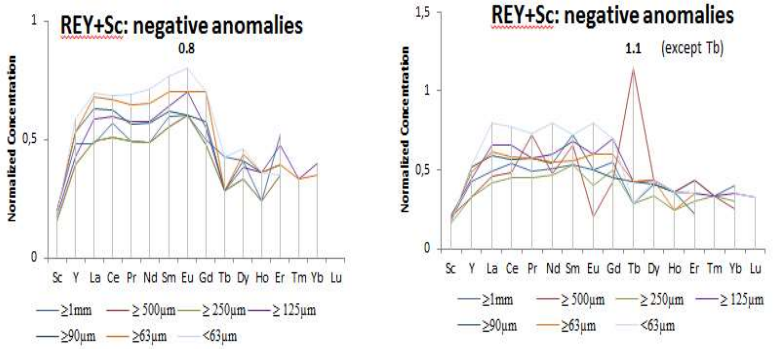
EVALUATION OF POSSIBLE RECYCLING DIRECTIONS FOR HEAVY AND RARE METALS RECOVERED FROM WASTE COMBUSTION PRODUCTS

The **RAREASH** project aimed to assess the possibility of using fly ashes and slags as a source of secondary raw materials for the production of strategic elements such as heavy and rare metals (HRM), including the lanthanides: Sc, Y, Ga, Sr, Rb, Y and W.

Obtaining rare earth elements and other valuable metals from by-products of coal combustion can be a new, prospective direction of their use, and the residues after separation of metals can be used in new or traditional composites for the construction of industrial or road structures.



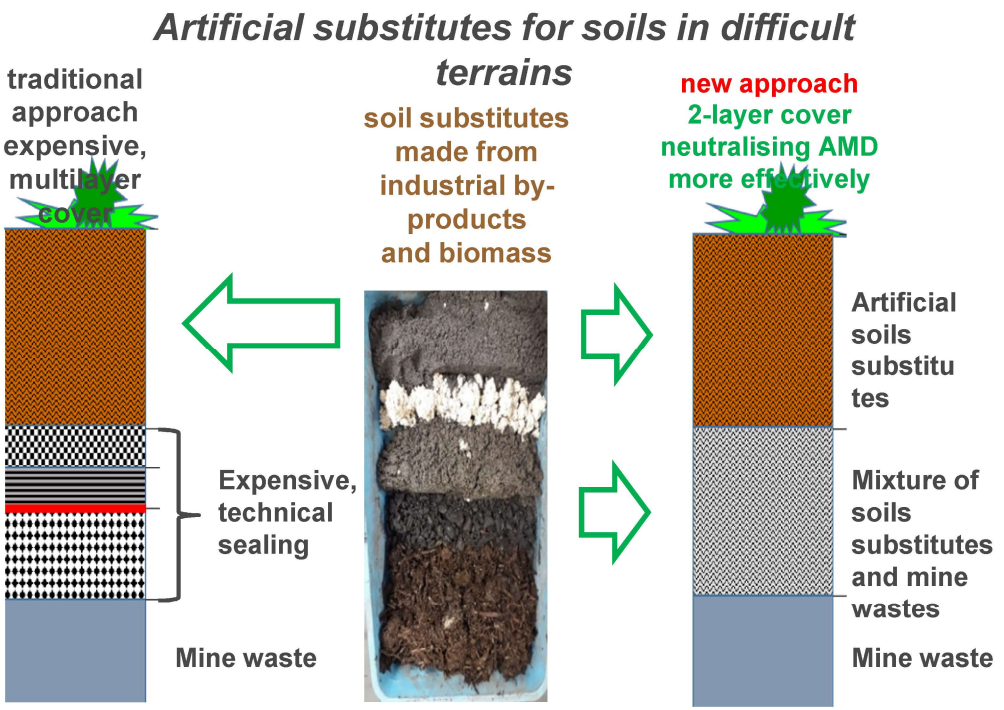




This project has received funding from the 2nd ERA-MIN Joint Call, implemented by an international consortium of 7 partners from 3 countries (Romania, Portugal, Poland). Financed by the National Center for Research and Development. Implementation period: 2015-

RECOVERY OF DEGRADED AND TRANSFORMED ECOSYSTEMS IN COAL MINING-AFFECTED AREAS

RECOVERY project focuses on land rehabilitation and ecological restoration of coal mining-affected areas, aiming to accelerate the recovery of degraded and transformed ecosystems to a good ecosystem status, using environmentaly friendly industrial by-products and biomass



Project consortium: Poland (coordinator), Czech Republic, Germany, Spain
The RECOVERY project received funding from the European Union under the RFCS Grant Agreement
no. 847205-RECOVERY-RFCS-2018709868 Implementation period: **2019 - 2023**

VERY FILM_UPDATE (1

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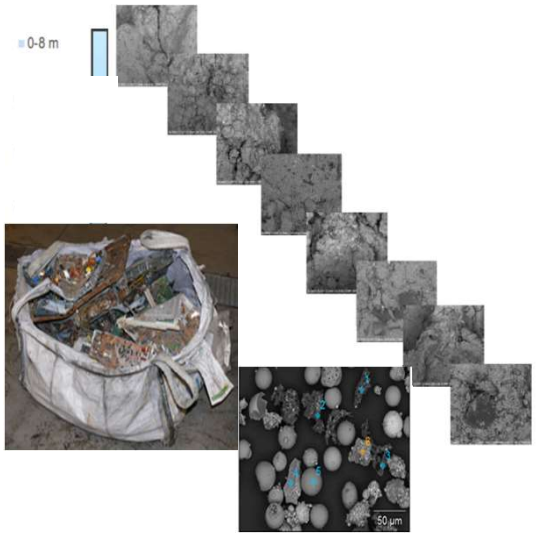
CIRCULAR ECONOMY

- COAL BY-PRODUCTS
- MINING WASTE
- ELECTRONIC WASTE
- BIOMASS



RAREAS

Recovery
RFCS RESEARCH PROJECT

CERES

MINRESCUE

CO2 COALBYPRO

- ✓ SORBENTS
- ✓ BUILDING MATERIALS
- ✓ CRITICAL ELEMENTS
- ✓ ARTIFICIAL SUBSTITUTES FOR SOILS/ SUBSTITUTES FOR COMMERCIAL FERTILIZERS

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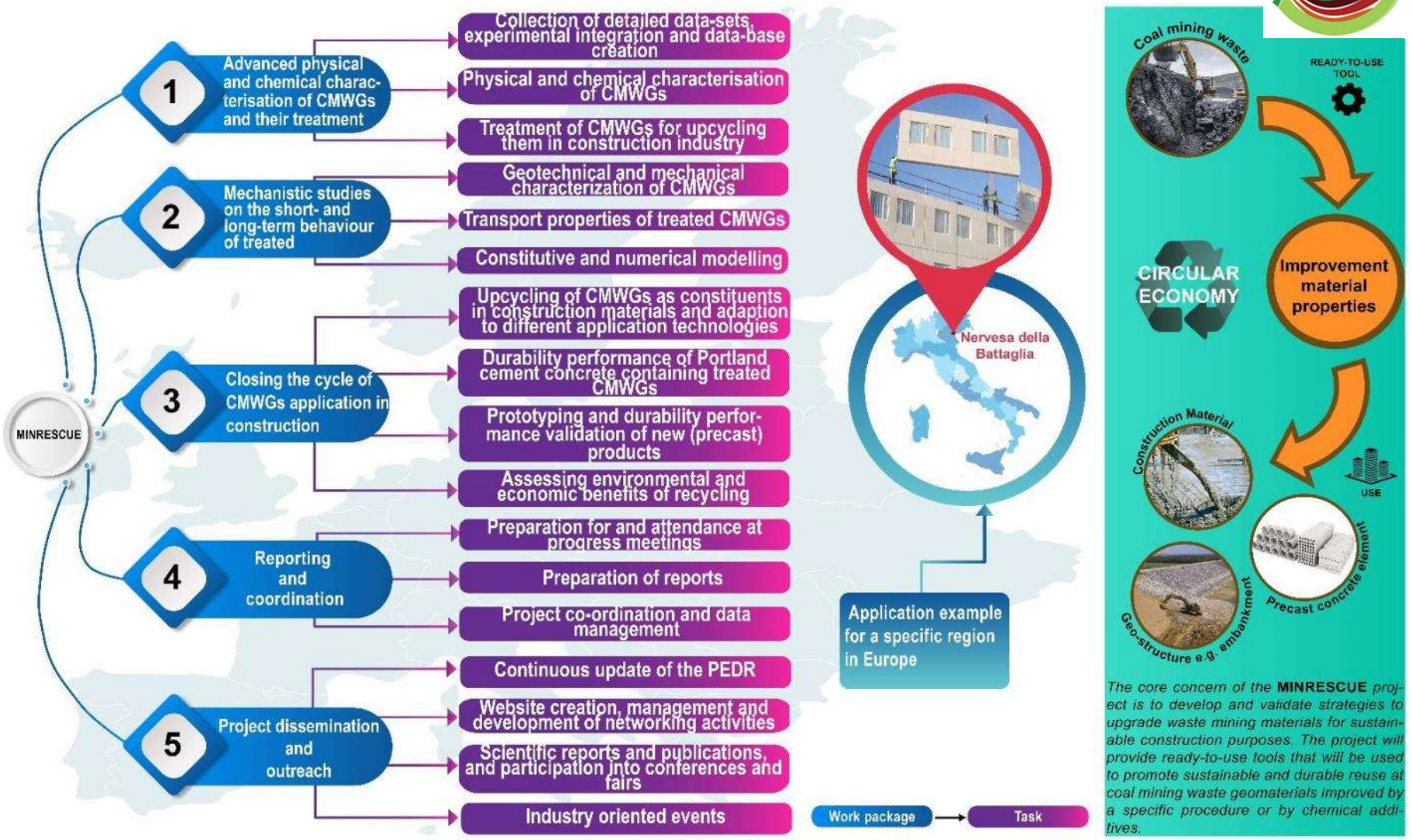
Projekt MINRESCUE– Produkty dla górnictwa w polimetobetonu

Struktura projektu / Zadania badawcze



CELE PROJEKTU

- Scharakteryzowanie właściwości mechanicznych i chemicznych odpadów wydobywczych, które mogą być wykorzystane w budownictwie i geoinżynierii.
- Ocena parametrów wytrzymałościowych oraz trwałości materiałów i produktów dla budownictwa, wykonanych z wykorzystaniem odpadów pogórniczych, w warunkach odwzorowujących rzeczywiste.
- Dostarczenie wytycznych dotyczących projektowania materiałów budowlanych i konstrukcji z odpowiednio przetworzonych odpadów pogórniczych, w celu umożliwienia aplikacji rezultatów projektu.
- Ocena wpływu na środowisko opracowanych rozwiązań technologicznych poprzez dogłębną ocenę cyklu życia (LCA).
- Rozpoczęcie wdrożenia rezultatów projektu poprzez budowę prototypu i monitorowanie oraz ocenę cyklu życia.

Projekt MINRESCUE otrzymał dofinansowanie z Unii Europejskiej w ramach RFCS Grant Agreement nr. 899518 i Ministerstwa Edukacji i Nauki (nr Umowy 5167/FBWiS/2021/2)

SKŁAD KONSORCJUM

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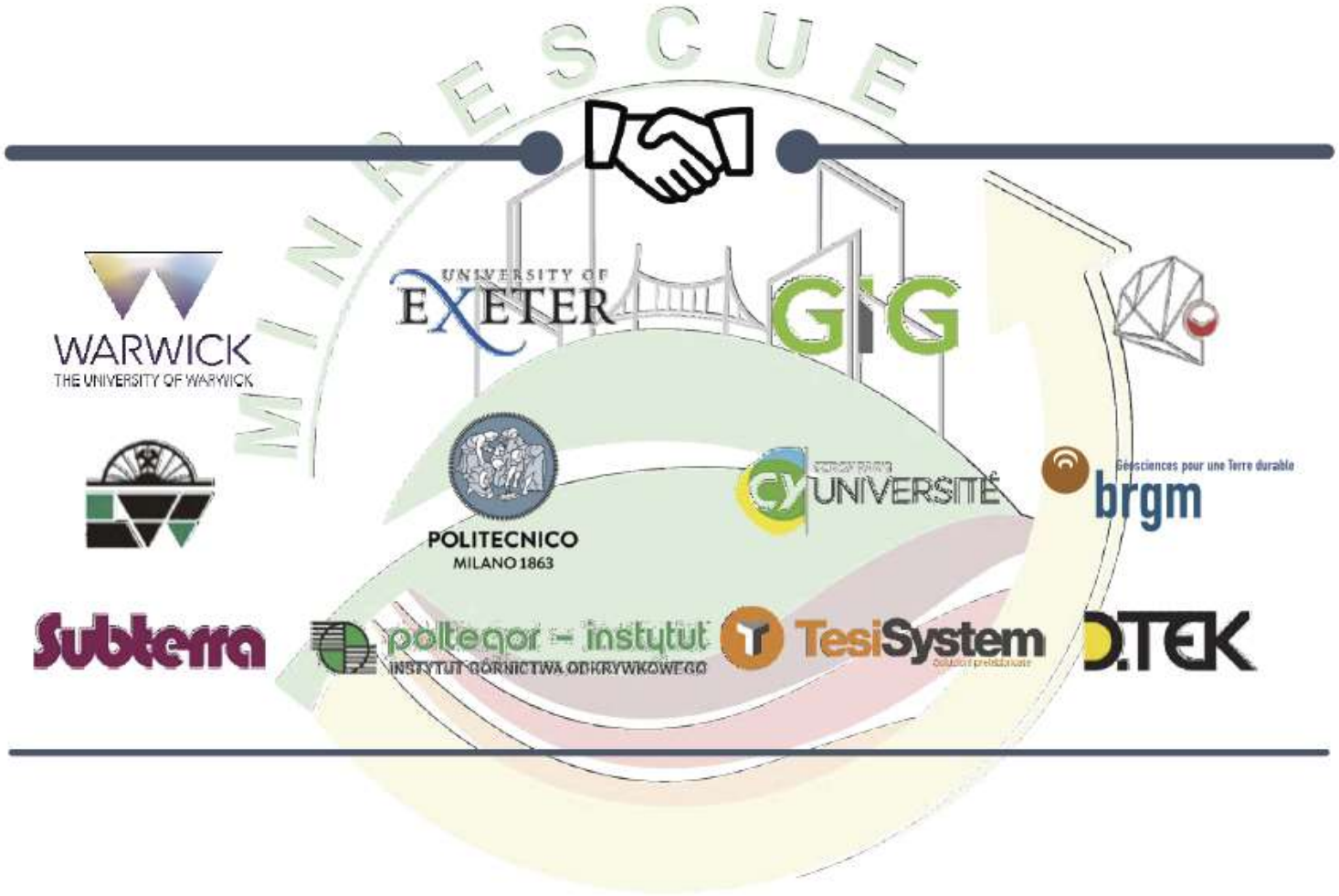

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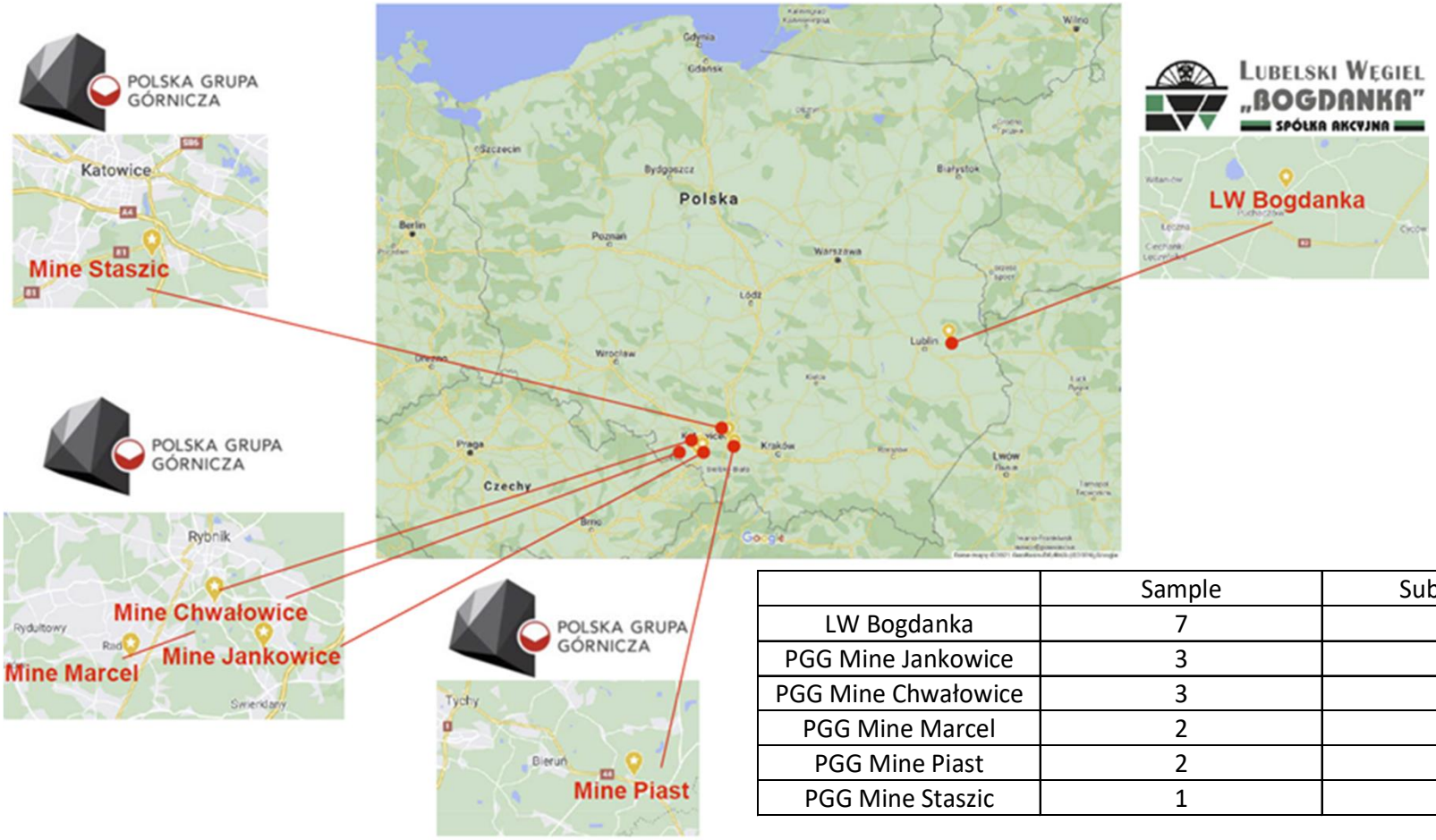
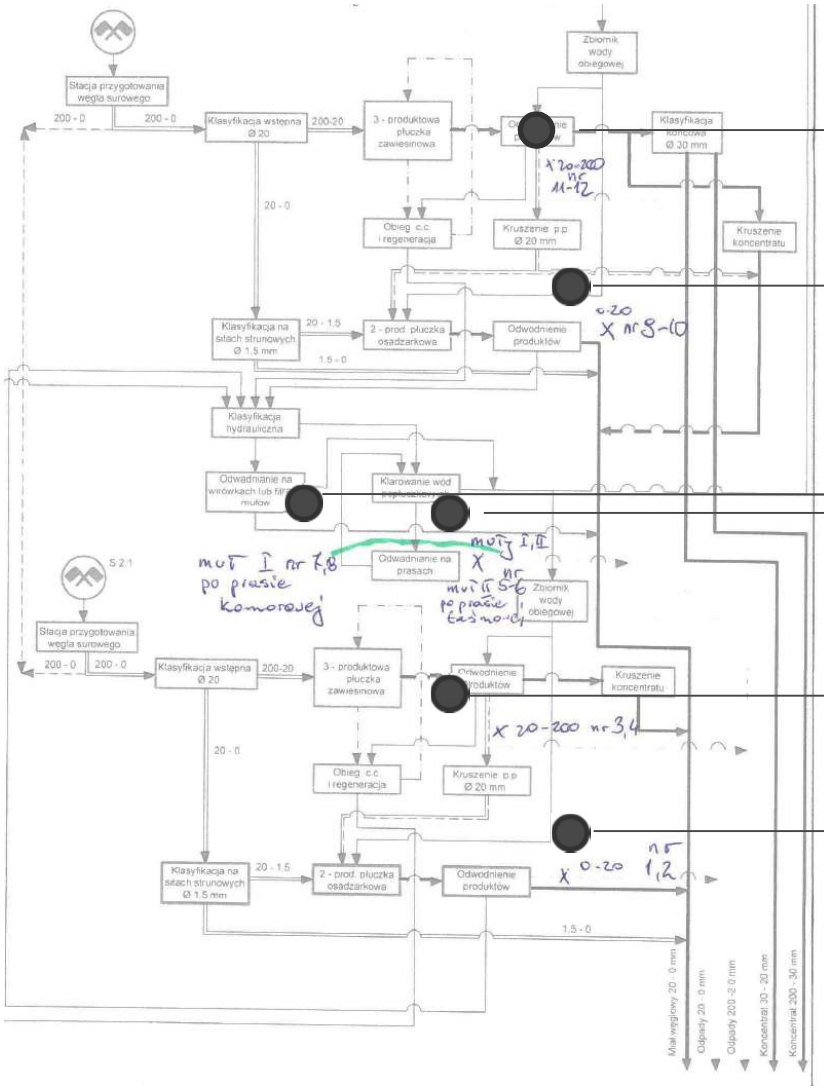
POBRANE ODPADY



	Sample	Sub-sample
LW Bogdanka	7	3
PGG Mine Jankowice	3	7
PGG Mine Chwałowice	3	10
PGG Mine Marcel	2	12
PGG Mine Piast	2	9
PGG Mine Staszic	1	5

POBRANE ODPADY



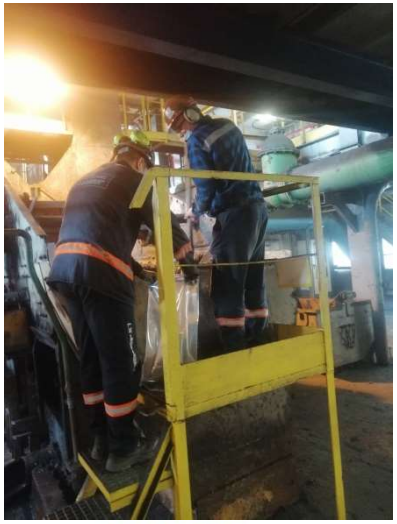
mine waste DISA 20-200mm

mine waste JIG 0-20mm

sludge CHAMBER FILTER PRESS 0-1mm

sludge BELT FILTER PRESS 0-1mm

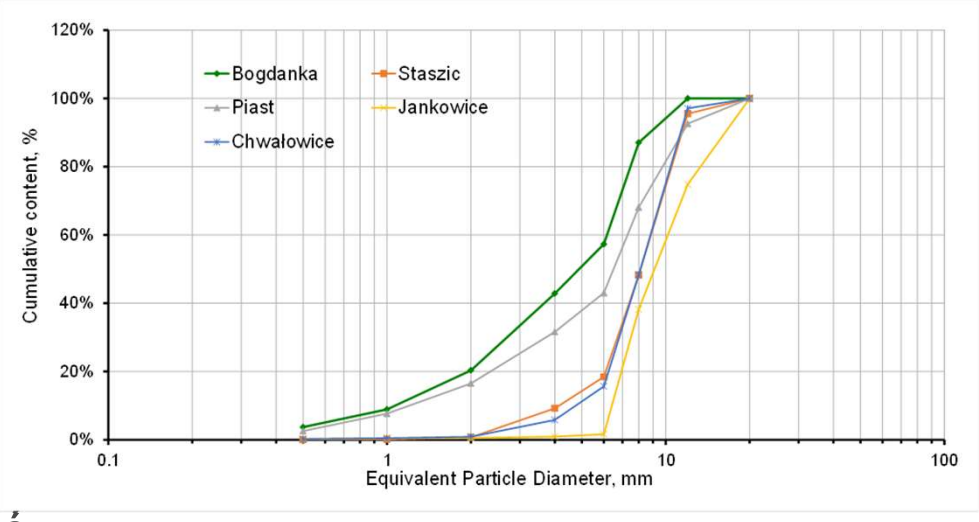
mine waste DISA 20-200mm



mine waste JIG 0-20mm

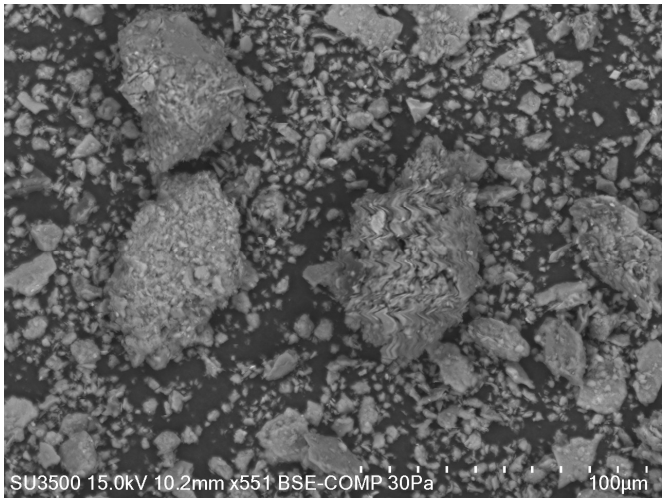
CHARAKTERYSTYKA ODPADÓW

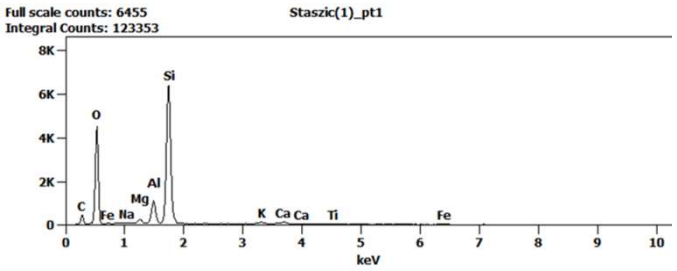
- skład ziarnowy,
- ciężar objętościowy,
- skład petrograficzny,
- gęstości suche i nasypowe,
- zawartość popiołu,
- optymalna zawartość wody,
- analiza densymetryczna,
- zawartość siarki, kaloryczność, wilgotność, zawartość węgla.

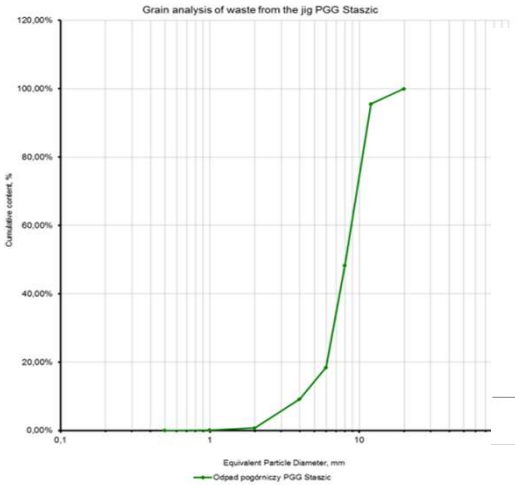


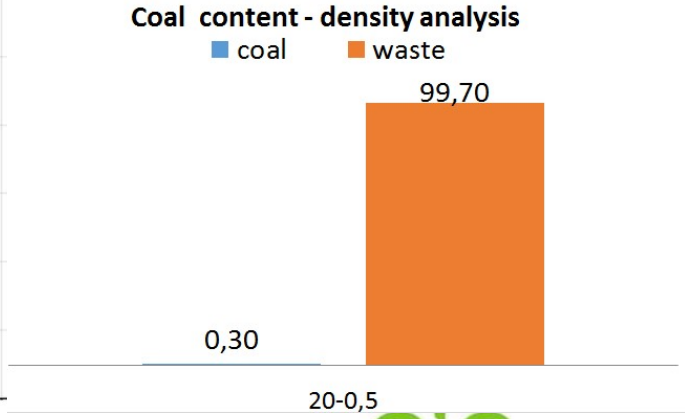
MINRE-STASZIC-001

Determination	MINRE-STASZIC-001/3	
	Content / Determined value	
	as received analytical state	dry state
	{%m/m)	
water (analytical moisture) *	**1,07**	
ash *	**90,67**	**91,65**
carbon *	**2,02**	**2,04**
hydrogen *	**0,19**	**0,19**
sulphur *	**0,16**	**0,16**
organic carbon TOC *	**2,02**	**2,04**
	[J/g (kJ/kg)l	
gross calorific value	**370**	**370**
net calorific value	**290**	**320**
specific density	**2,64 g/cm**	



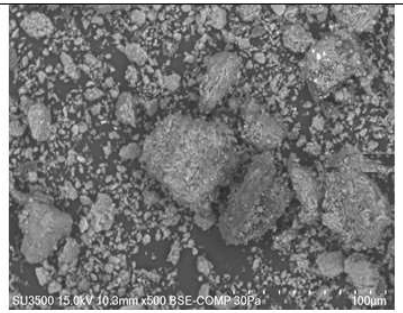






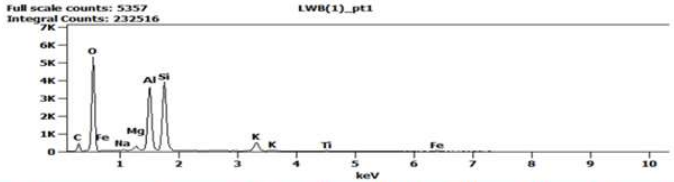
CHARAKTERYSTYKA ODPADÓW

MINRE-LWB-001



Grain class mm	Yield kg	Yield kg	Total Yield %
+ 20	0	0,00	100,00
20 – 12	7,7	12,94	100,00
12 – 8	17,7	29,75	87,06
6 – 8	8,6	14,45	57,31
6 – 4	13,4	22,52	42,86
4 – 2	6,8	11,43	20,34
2 – 1	3,1	5,21	8,91
1 – 0,5	1,3	2,18	3,70
-0,5	0,9	1,51	1,51

Determination	Content / Determined value	
	as received analytical state	dry state
	(%m/m)	
water (anaiytical moisture)	1,49	
ash	81,27	82,5
carbon	7,67	7,79
hydrogen	< 0,11	<0,11
sulphur	1,85	1,88
organic carbon TOC	7,67	7,79
	[J/g (kJ/kg)]	
gross calorific value	2810	2850
net calorific vaiue	2760	2850
specific density	2,48 g/cm	

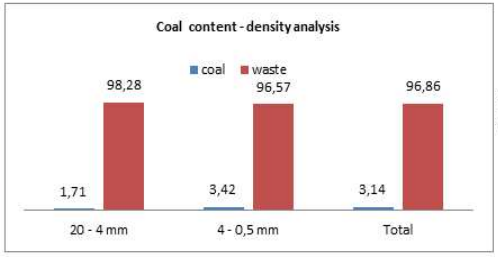


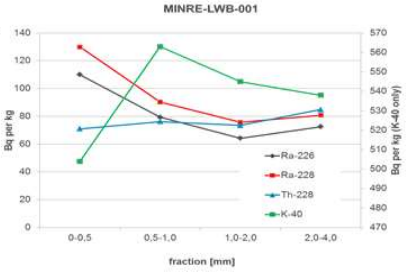
	CO2		F	Na2O	MgO	Al2O3	SiO2	SO3	K2O	TiO2	Fe2O3
LWB(1)_pt1	19.13	0.00		0.43	1.68	27.62	42.02		5.65	0.66	2.81
LWB(1)_pt2	75.24	0.00		0.28	0.31	8.80	11.79	1.95	0.76		0.88
LWB(1)_pt3	23.69	0.00	0.00	0.54	1.40	26.75	41.37		3.03	0.87	2.35
LWB(1)_pt4	24.68	0.00	0.00	0.41	0.60	29.16	41.59		1.15	0.91	1.50

Density Analysis			
%	20 - 4 mm	4 - 0,5 mm	Total
coal	1,71	3,42	3,14
waste	98,28	96,57	96,86
			100,00

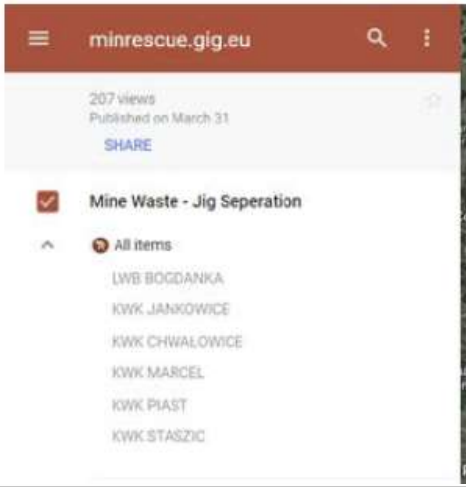
Radionuclides Concentration

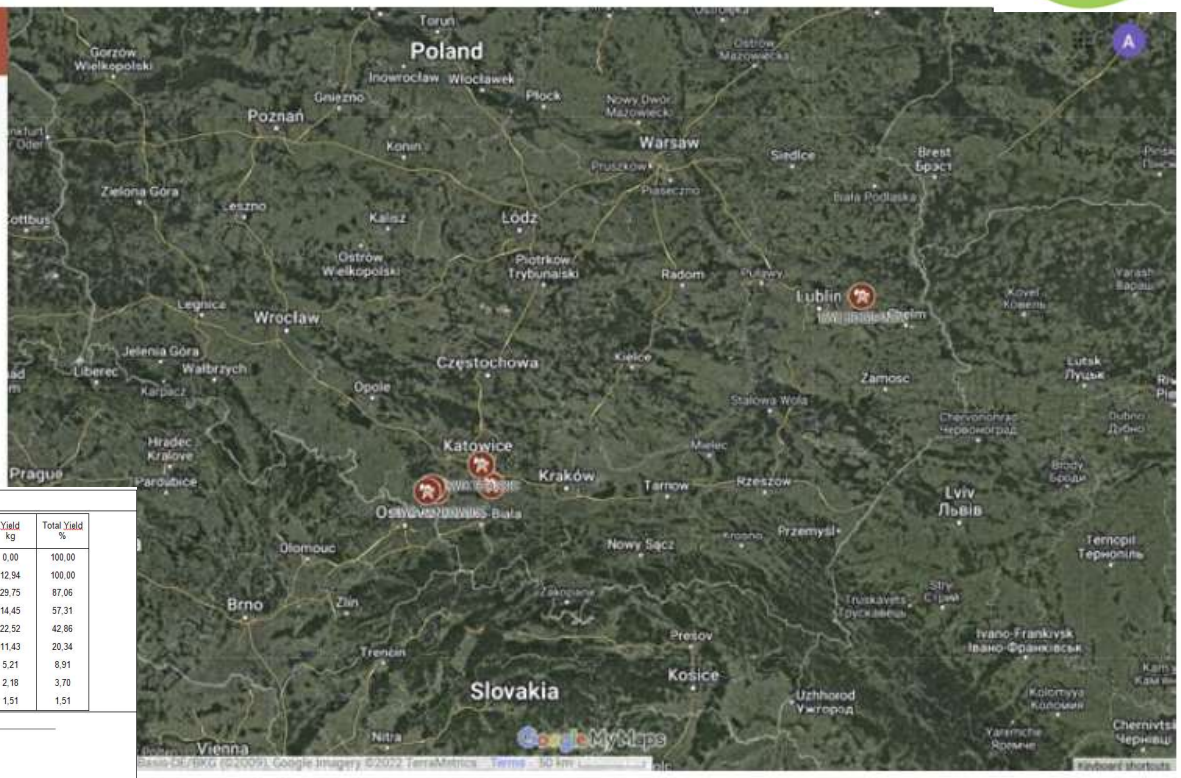
Sample	Ra-226	ΔRa-226	Ra-228	ΔRa-228
MINERE-LWB-001	63,5	± 3,6	93,3	± 4,6
	Th-228	ΔTh-228	K-40	ΔK-40
	76,2	± 4,6	514	± 73
	Pb-210	ΔPb-210		
	70	± 20		



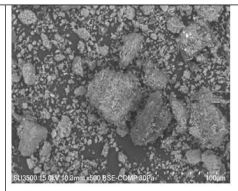


BAZA DANYCH





MINRE-LWB-001



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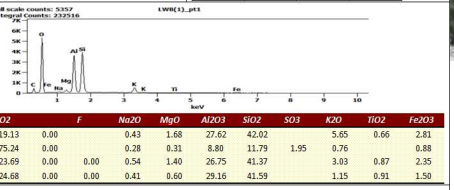

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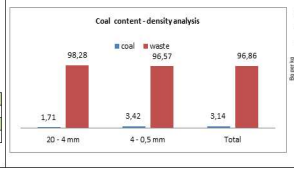
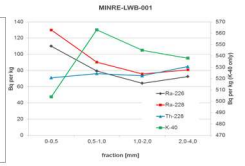
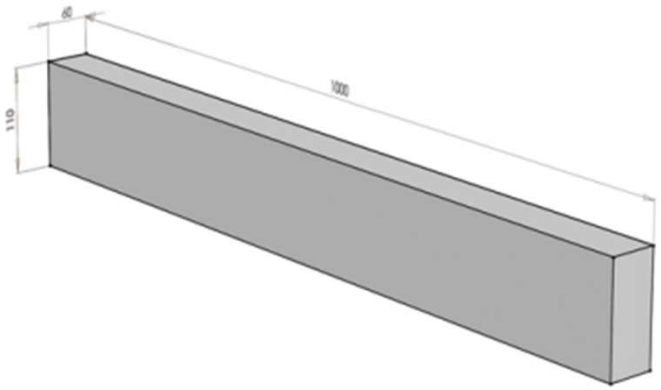
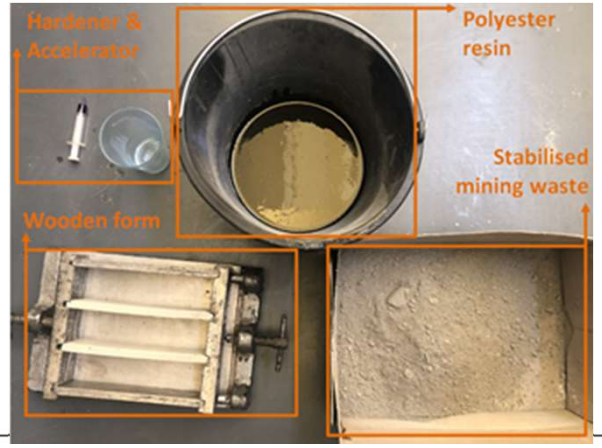
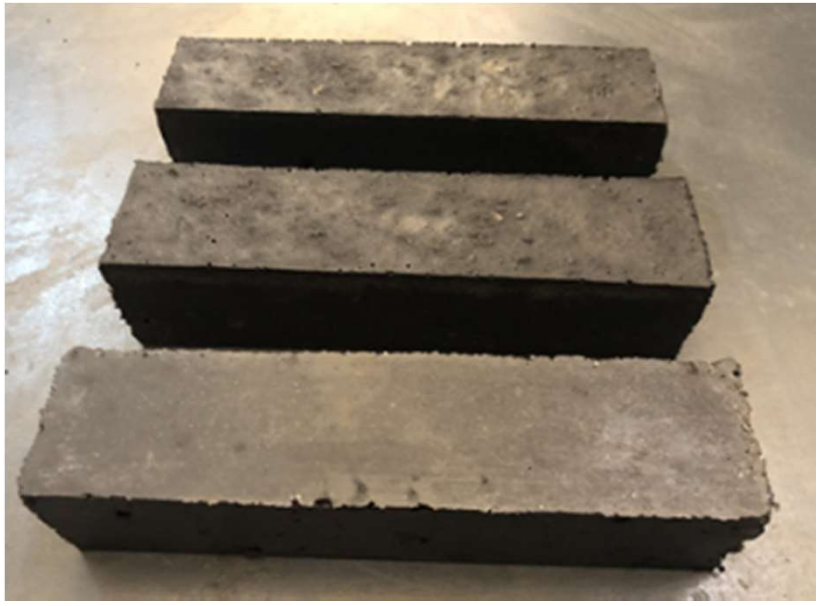




USE STABILISED MINING WASTES TO DEVELOP POLYMER CONCRETE PRODUCTS TO BE USED IN MINING INDUSTRY







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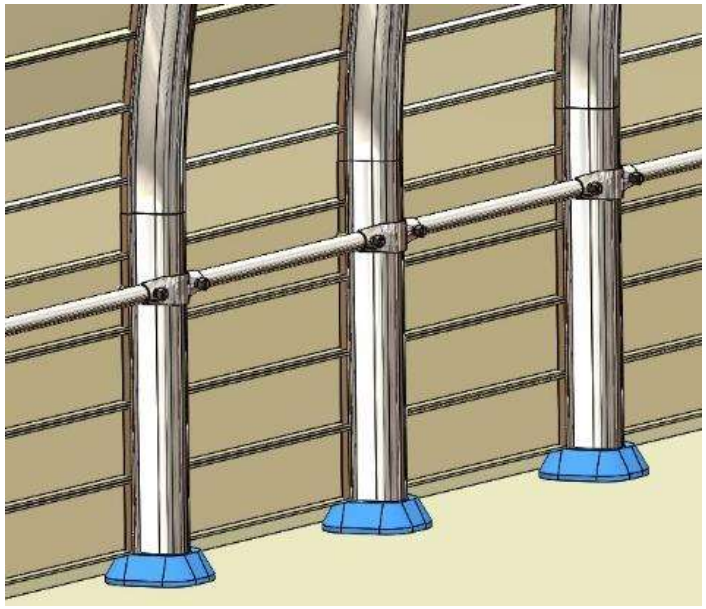
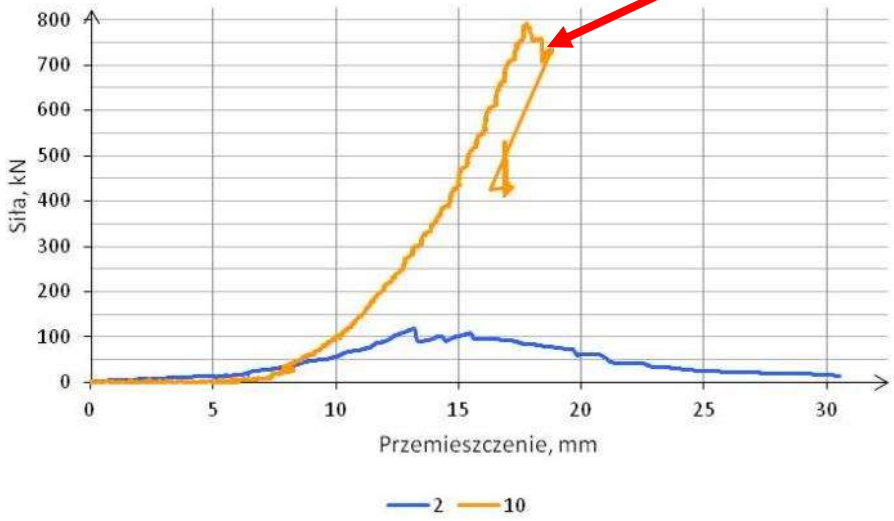
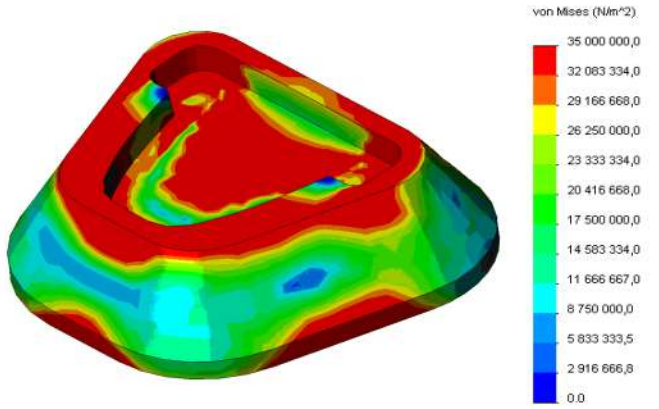
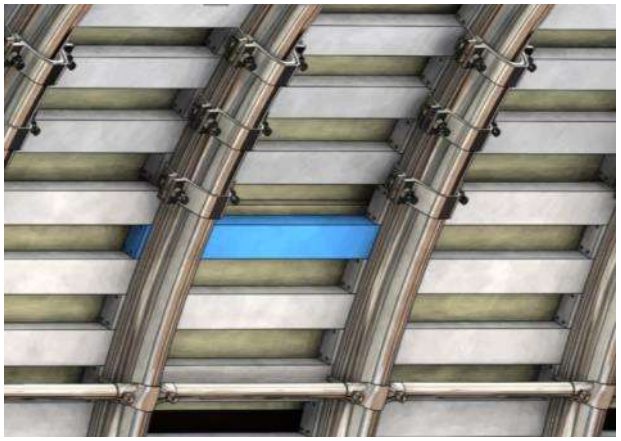
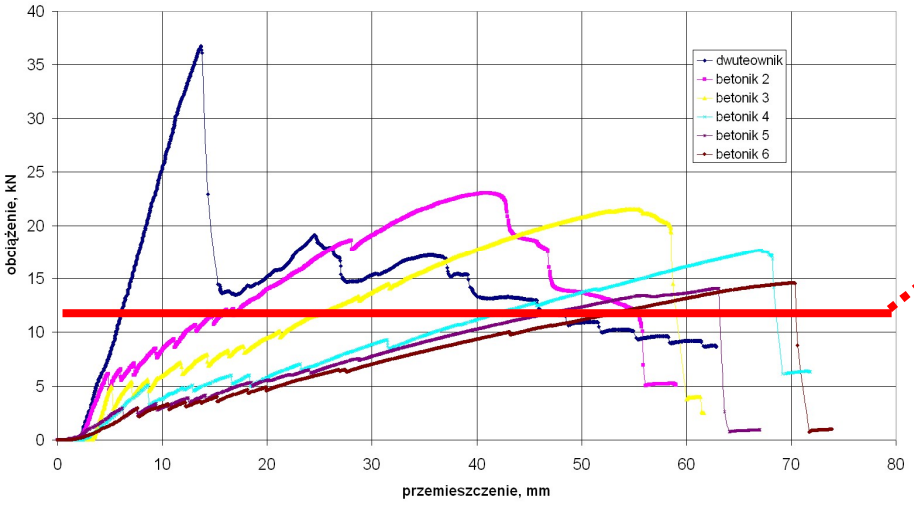


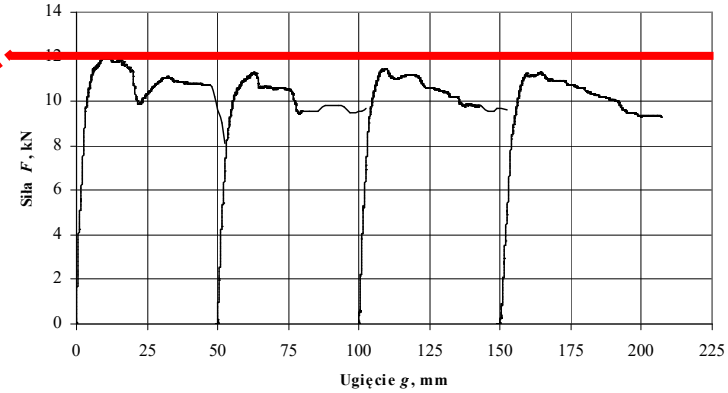

11


800
700
600
500
400
300
200
100
0
Siła, kN
0
5
10
15
20
25
30
Przemieszczenie, mm
2
10


von Mises (N/m^2)
35 000 000,0
32 083 334,0
29 166 668,0
26 250 000,0
23 333 334,0
20 416 668,0
17 500 000,0
14 583 334,0
11 666 667,0
8 750 000,0
5 833 333,5
2 916 666,8
0.0




obciążenie, kN
przemieszczenie, mm
dwuteownik
betonik 2
betonik 3
betonik 4
betonik 5
betonik 6


Siła F, kN
Ugięcie g, mm

MIESZANINY POLIMEROBETONÓW Z WYKORZYSTANIEM ODPADÓW GÓRNICZYCH

MIESZANINY POLIMEROBETONÓW Z WYKORZYSTANIEM ODPADÓW GÓRNICZYCH

POLSKA GRUPA GÓRNICZA

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MIESZANINY POLIMEROBETONÓW Z WYKORZYSTANIEM ODPADÓW GÓRNICZYCH

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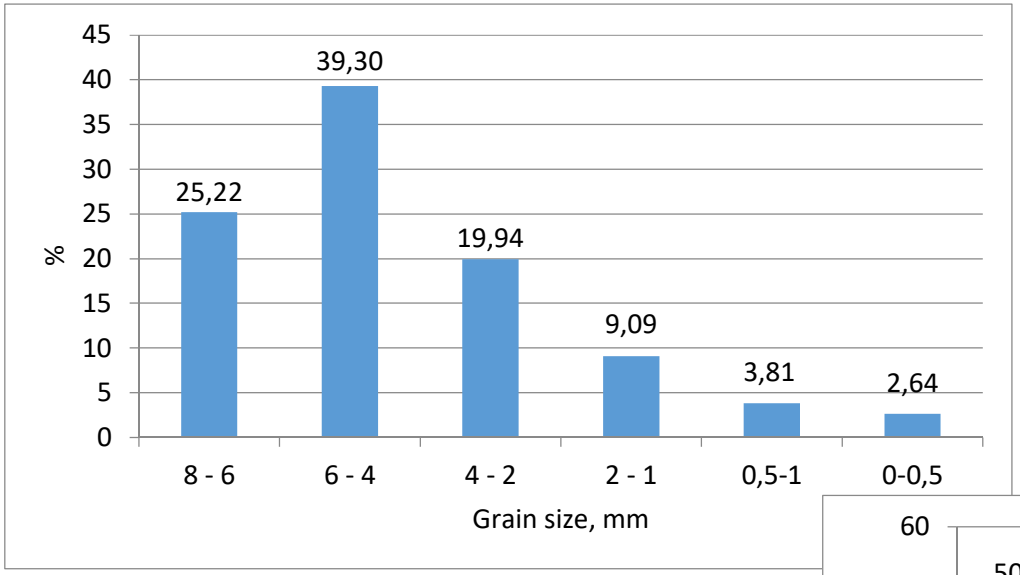
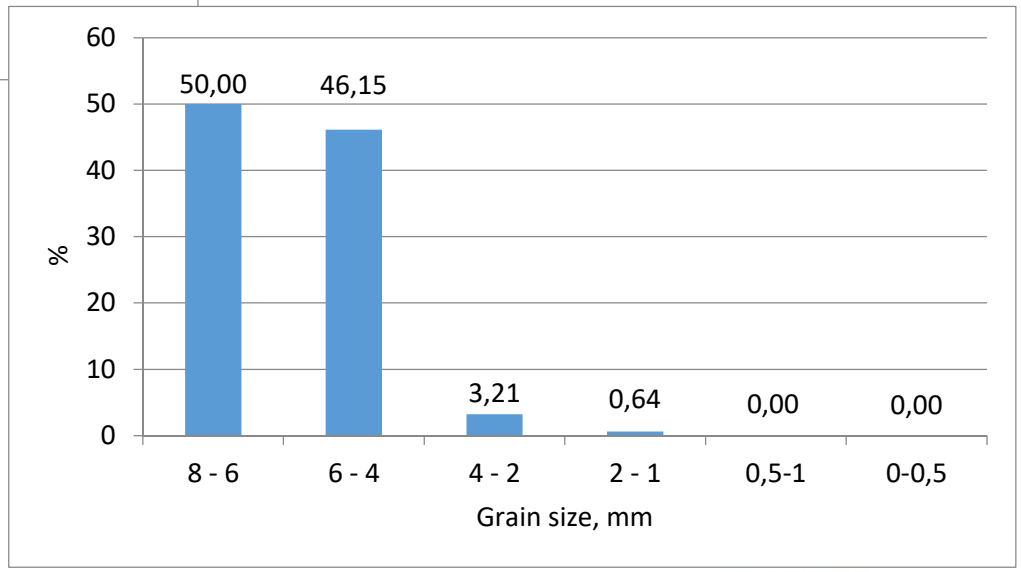
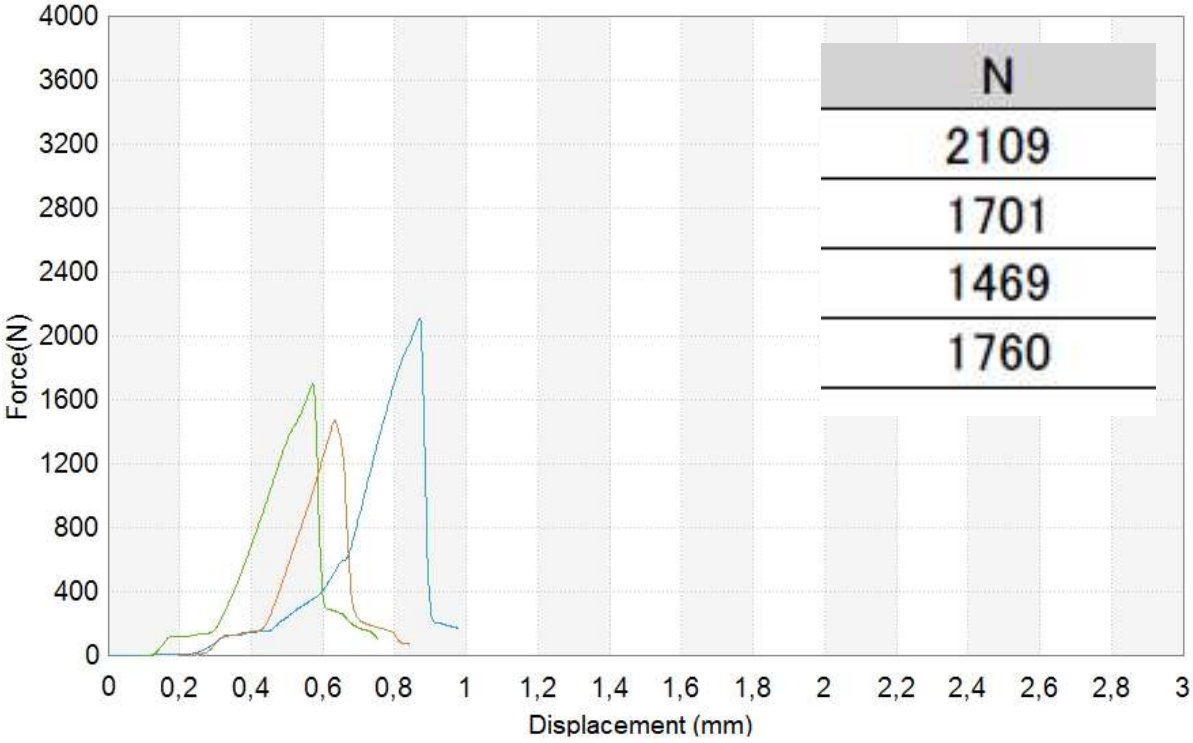




MIESZANINY POLIMEROBETONÓW Z WYKORZYSTANIEM ODPADÓW GÓRNICZYCH



MIESZANINY POLIMEROBETONÓW Z WYKORZYSTANIEM ODPADÓW GÓRNICZYCH

Coal sludge

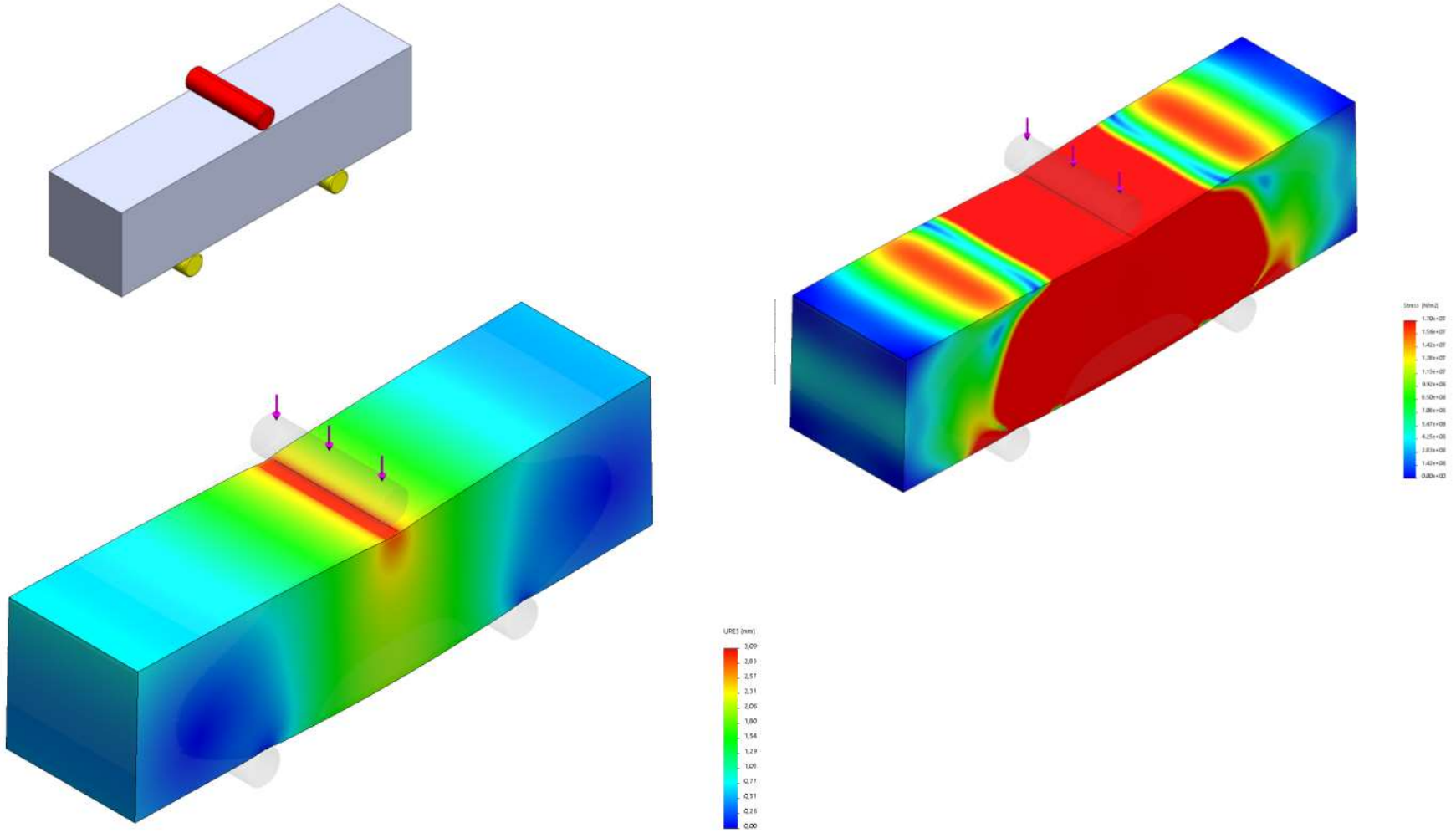
CaO, 5 wt. %

Cycle length
240 - 300 s.

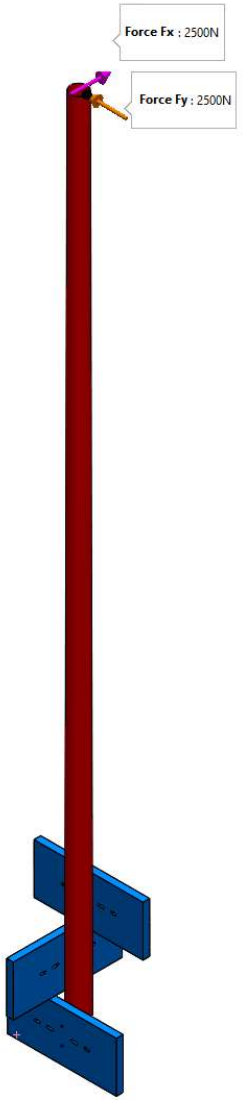
Sieve analysis

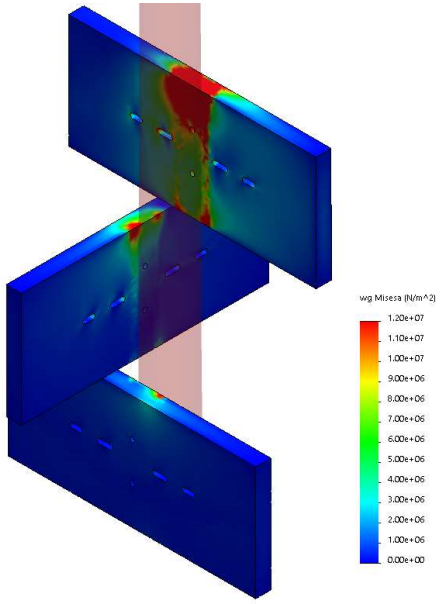
Obtained granules

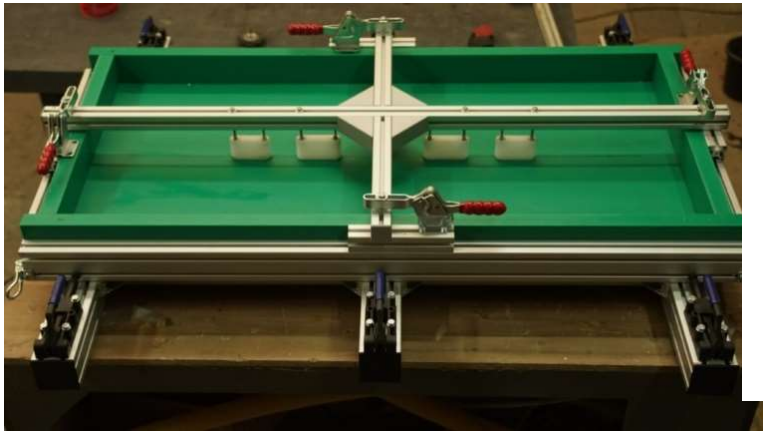
MODELOWANIE NUMERYCZNE



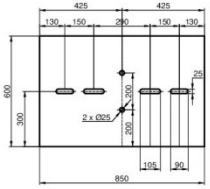
MODELOWANIE NUMERYCZNE



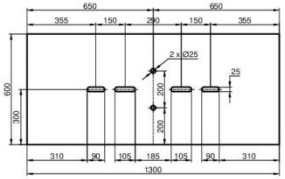




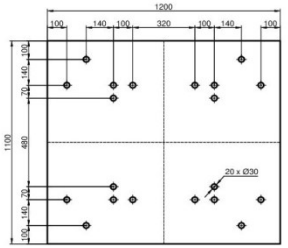
U-85



U-130



P-120



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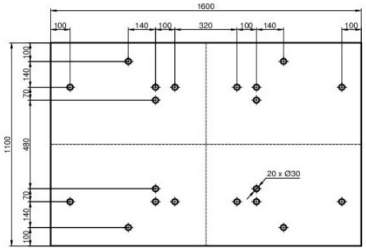
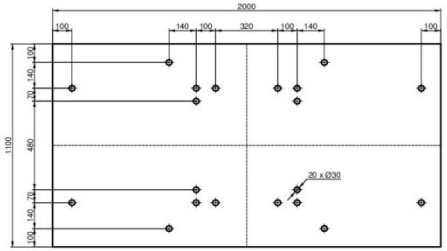


P-200



Dziękuję za uwagę

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