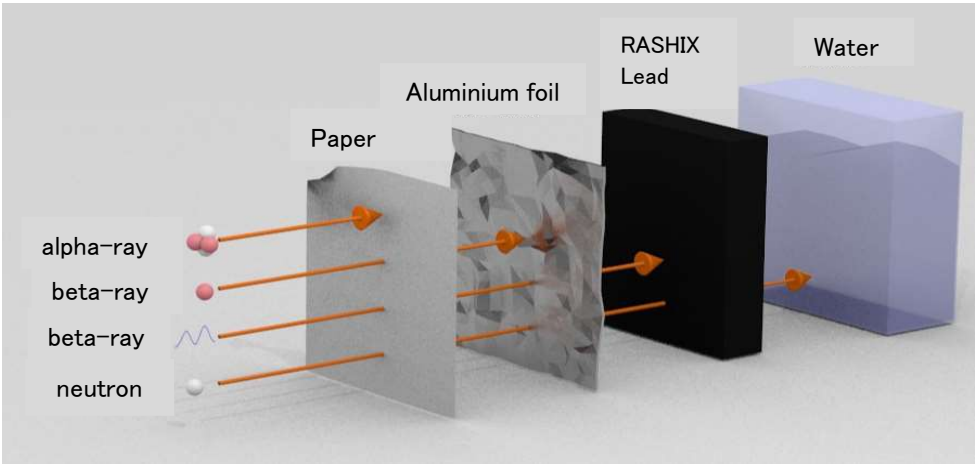
RASHIX

Ceramics that efficiently shield radiation

Mitsuishi Taikarenga Co., Ltd.

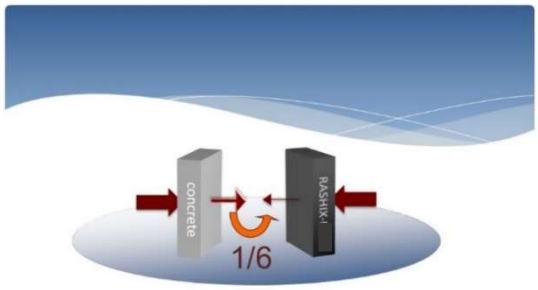
Basic knowledge of radiation

Radiation includes α rays, β rays, γ rays, and neutron rays. Of these, α rays and β rays have low penetrating power. For example, α rays can be shielded with a piece of paper and β rays can be shielded with a thin aluminum foil. γ -rays and X-rays are high-energy electromagnetic waves and have high penetrability, so it is impossible to completely shield them with ordinary substances. Lead is well known as a shield against γ rays and X rays. RASHIX can also efficiently shield γ rays and X rays. On the other hand,the principle of shielding nuetron is different. Fast neutrons generated by nuclear reactions can be decelerated by water and absorbed by boron.



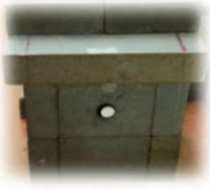
Shielding performance

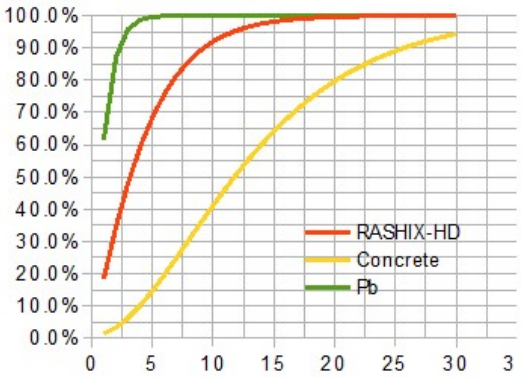
The density of RASHIX is 4.9g/㎤, which enable to shield radiation effectively. For example, the penetrating rate though 10 cm of RASHIX for gamma ray emitted from cesium137 is one sixth of that of concrete. And also, the thickness of RASHIX can equivalently shield with a half of that of concrete. By halving the thickness of the stracture, land and buildings can be used much more effectively.



Verification results of shielding performance

As a result of conducting various tests of shielding performance verification at Tokyo Metropolitan Industrial Technology Center, Okayama University of Science, and Osaka Prefecture University, high radiation shielding performance was verified. We also conducted a storage test of radioactive waste in a RASHIX shielding box at a temporary storage site for decontamination waste in Fukushima Prefecture. As a result of measuring the shielding rate of gamma rays emitted from cesium137 which is a radioactive waste, the shielding rate of 98.4% was obtained with a shielding thickness of 17 cm, and the shielding performance of RASHIX was reconfirmed.



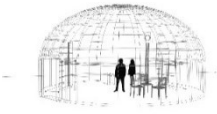


Occlusion rate

thickness [cm]	RASHIX	Concrete	Pb
1	17.00%	1.36%	61.60%
2	32.06%	3.27%	87.05%
3	45.05%	6.23%	95.85%
4	55.99%	10.10%	98.70%
5	65.04%	14.66%	99.60%
6	72.43%	19.69%	99.88%
7	78.39%	25.01%	99.96%
8	83.15%	30.44%	99.99%
9	86.92%	35.86%	100.00%
10	89.89%	41.17%	100.00%
11	92.21%	46.30%	100.00%
12	94.02%	51.19%	100.00%
13	95.43%	55.81%	100.00%
14	96.51%	60.12%	100.00%
15	97.34%	64.13%	100.00%
16	97.98%	67.84%	100.00%
17	98.47%	71.23%	100.00%
18	98.84%	74.33%	100.00%
19	99.13%	77.15%	100.00%
20	99.34%	79.71%	100.00%
21	99.50%	82.01%	100.00%
22	99.63%	84.08%	100.00%
23	99.72%	85.94%	100.00%
24	99.79%	87.60%	100.00%
25	99.84%	89.08%	100.00%
26	99.88%	90.04%	100.00%
27	99.91%	91.57%	100.00%

Use

- As X-ray protection in medical facilities and radiation shielding material for linear accelerators and heavy ion radiotherapy equipment
- Ensuring the safety of radiation workers
- As an emergency measure in a nuclear power plant or a shelter for workers
- Storage container for radioactive waste such as decontamination waste
- Nuclear shelter shielding material



Features

Specific density overturning common sense

It has a density of 4.9 g /㎤, much heavier than concrete or heavy concrete, which enables to shield radiation efectively.

Free of harmful substances

Since it does not contain heavy metals such as lead, it can be used with security.

High tolerance agaist agerelated detereoration

Because it's the ceramic manufactured by firing at high temperatures, it is strong agaisnt aging.

Can be manufactured in any shape

It can be manufactured in a shape that matches the application and design.

High strength

It has a very high strength (compressive strength is 200MPa) and can build a solid structure.

Excellent in chemical resistance

The RASHIX test samples are soaked in each reagent at room temperature and leave it for 48 hours. Changes in the dry weight and appearance of the specimen are shown below.

result

reagent	Chemical formula	Reagent concentration	Weight change 0.5% or less is N/A	Ceramics Department
hydrochloric acid	HCl	10%	N/A	No change
nitric acid	HNO3	10%	N/A	No change
phosphoric acid	H3PO4	10%	N/A	No change
hydrofluoric acid	HF	10%	N/A	No change
acetic acid	C2H4O2	100%	N/A	No change
sodium hydroxide	NaOH	40%	N/A	No change
sodium chloride	NaCl	10%	N/A	No change
acetone	CH3COCH3	100%	-0.55%	No change
kerosene	-	100%	N/A	No change

Reusablility

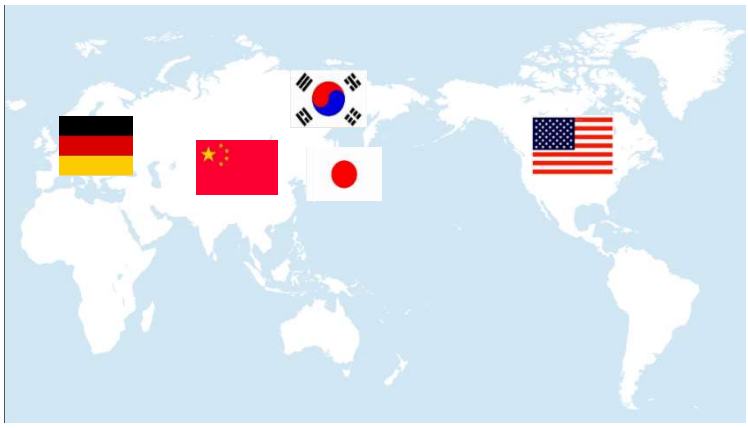
Since it is a brick, it can be reassembled and reused. It has excellent economical efficiency.

Mass production is possible

The raw materials for RASHIX can be stably obtained in large quantities.

Patent

Patented in Japan, USA, China, Korea, Germany



RASHIX regenerates a natural environment where people can live in peace mind and restores a safe social environment

We have developed ceramics that shield radiation effectively by gahtering our technologies of refractory brick manufacturing cultivated though our long history.

Advanced technology and safety of material are required for the treatment of radioactive wastes contaminated with radioactive materials, the shielding of radiation in medical facilities and nuclear facilities. RASHIX is a safe product that does not contain heavy metals such as lead. We have created a highly-dense and extremely heavy ceramics, making the most of the original properties of ceramics. This high density enable to shield radiation efficiently.
We will continue to challenge ourselves to provide better products, hoping that people around the nuclear power plants, needless to say of people in disaster-striken area, can live in peace and safety,and trying to protect people's health and safety who treat radiation in any field.

RASHIX is named after Radiation Shielding Ceramics

Transcript

成績証明書

依頼品	RADIX
依頼事項	遮蔽率の測定（セシウム１３７）

地方独立行政法人
東京都立産業技術研究センター理事長

Measurement of gamma ray shielding rate

ガンマ線遮蔽率の測定

依頼品名：RADIX

測定年月日：平成２６年４月１４日

測定方法：床から１.２mの高さで、線源と検出器の測定中心までの距離を３０cmとし、その間に試料がない場合とある場合について、線量率をそれぞれ１０回の測定を行い、その平均値より遮蔽率を求めた。

線　　源：セシウム１３７線源　公称値　１０MBq　（平成２２年１２月１６日）

測 定 器：応用光研工業製ＳＰＤ（１インチφ×１シンチレーション検出器）

測定結果：

測定試料	線量率（μSv/h）	遮蔽率（%）
RADIX	2.91±0.1	72.4

ただし、バックグランド（BG）の線量率は0.03μSv/h、試料のない時の線量率は10.1±0.2 μSv/hであった。
遮蔽率は、（1－（試料有-BG）／（試料無-BG））×100により求めた。

以上

Raw material analysis certificate

分析証明書

分析の対象	分析の単位	分析の結果	分析の方法
カドミウム	mg/l	0.001 未満	
鉛	mg/l	0.005 未満	
六価クロム	mg/l	0.02 未満	
砒素	mg/l	0.005 未満	
総水銀	mg/l	0.0005 未満	
セレン	mg/l	0.002 未満	
ふっ素	mg/l	0.08 未満	
ほう素	mg/l	0.01	
以下余白			