Refractory heat insulation - Thermal

Refractory thermal, light weight, heat resistant insulation is used to preserve the generated and stored heat energy inside the oven mass.

In the system of wood fired ovens, the energy from fire absorbed into the dense firing chamber must be retained within the mass, and only then, this simple but very efficient system lets the heat serve its purpose. This heat energy is meant to vibrate only inside the dome space and cook for us for a long time. That is all there is to it.

If the dome was not covered with some kind of light-weight thermic insulation material, the heat energy from the fire would quickly run away through the dense layer leaving the firebrick dome cooled down or cold. This isn't hard science at all, plus, in fact, it's also very easy to apply. If done properly that simple function gets truly amazing results.

In the nutshell:
Dome walls of the oven are made out of a dense material. This heavy material has quite a high thermal conductivity (inside itself it transfers and builds up the heat it faces.) Therefore the cooking chamber is capable of soaking in & retaining a lots of heat from the fire ... and lead it through all across its whole body mass.

Firebricks and other dense refractory materials have the capacity to conduct heat within them very well. That is why the heat-energy also enters right into the opposite outside edge very quickly. It soaks through. Literally in a high speed.

In other words, as much as the dome is hot on the inside, very fast the temperature gets equally hot on the outside. "That means the oven gets fully loaded with cooking energy :o) 'Oh no no ... don't get scared, it is totally very good for you!!!

We will just give the oven a nice warm coat to keep it warm, even though it is not a winter weather outside. And by doing it that way the heat won't escape out into the air, the energy remains only ours.

Refractory heat insulation types

Builders can choose from several refractory insulation types. Some are packed in bags and used simply in the loose form, by pouring it dry around and on top of a boxed-in dome, covering any shape or kind of cooking dome.

Then there is the blanket form of heat insulation (rolled in different lengths or pre-cut into smaller lengths usually 24" - 610mm wide standard size.)

You can easy prepare your own quality mix or buy insulation's that are mixed with water before an application. These can be cast or built up by hand. After setting the mix creates solid but still soft and lightweight efficient thermal insulating layer.

1. Dry, loose form heat insulation's that can be poured around and on top to cover the main cooking part:
Vermiculite or Perlite - both are being sold in different grade sizes. Choose one in the middle, do not get the fine dust size. Personally I use grade #3 Vermiculite. It is sold in larger landscaping or gardening yards for horticulture or even for building swimming pools. Vermiculite and Perlite are commonly used for thermally insulating those nice oven structures where the dome is boxed-in between e.g. building brick or metal sheet walls. More on vermiculite insulation.

Application thickness of 4" - 10cm plus will do for covering the oven.

2. Ceramic fibre insulating blankets or ceramic fibre pads:
This high technology option is perhaps a bit more costly but in a limited space area for wood oven it will help perfectly. Sold in different grades, for wood oven you'll need lowest grade because top grades of this material can be used in stoneware high temperatures and also on the hot face (and a lot higher). If you want to use ceramic fibre you only need to place it around the walls and top, often a good grade will require only 1" - 2.5cm to 2" - 5cm width. Don't put anything heavy on top, like other layer or insulation or wet layer of mortar etc., it shouldn't be squashed down at all, the high quality of insulation would be degraded/lost (remember the honeycomb effect?)

Ceramic fiber insulation blankets need to be hidden/protected against humid and dusty conditions, behind a casing, so the material does not deteriorate unnecessarily.

*WARNING when working with these blankets wear gloves and respiratory mask as it releases sharp dust particles which many people are allergic to, watch that silicosis. Silicosis is not dangerous as asbestosis (**unrelated but** still for the awareness asbestos awareness - work & safety page.)*

Sold are also ceramic fiber insulations in form of a loos wool, like a fluff, which can be pushed into narrow areas but don't pack it too much, not to make it into hard solid or it will not insulate well. Available in refractory or pottery supplies shops. I'll take picture of the blanket and add it in here.

Mixed refractory insulation's:
13 : 1 : 1 - Vermiculite, Portland cement, Lime. Mix all dry ingredients then add small water amount in stages while mixing. This will become solid but stays soft! Used e.g. for covering of the dome e.g. into barrel or igloo effect on the outside. (It is not insulating concrete or mortar.) Apply in 2.5cm - 1" layers, do 3-4 or more of them allow each layer to set before following one. Last, still insulating layer, can be thinner with double amount of cement. Finally for the weather finish, the oven can be rendered on chicken wire, just like the stucco on old wooden houses.

13 : 1 : 1 - Perlite, Portland cement, Lime. Mix all dry ingredients then add small water amount in stages while mixing. This will become solid but stays flexible! Used e.g. for covering of the dome e.g. into barrel or igloo effect on the outside. (It is not insulating concrete or mortar.) Apply in 2.5cm - 1" layers, do 3-4 or more of them allow each layer to set before following one. Last and still insulating layer, can be thinner with double amount of cement. Finally for the weather finish, the oven can be rendered on chicken wire, just like the stucco on old wooden houses.

Thicker insulation application for under the hearth slab

Heat resistant insulation for under the floor slab can be simply 5:1 - mix of Vermiculite : Portland Cement (or often called also GP cement.)

This insulating layer has also metal mesh under (the mix is then poured on top of the mesh). Mixing this type requires of approximately 1 part of water and 6 parts of dry matter, which makes it dry stuff to water 6:1 . . . (in other words: 5 + 1 = 6 parts of dry ingredients which is vermiculite and cement and water 1 part. All measuring is done fast in volume sense, NOT in weight.) Mix first only the dry Vermiculite and cement together. Then add into it only ~80% of the required water amount and mix. From the beginning it feels rather dry but as you progress with mixing you will realize that adding just a bid of water could make it very runny easily.

I place into wheelbarrow 5 cans of Vermiculite, 1 can of cement, mix it with shovel there, then I add 1 full can of water and finish mixing. This makes me full wheelbarrow of insulation material. Because insulating ingredients are so much lighter in weight, when compared for instance with any sand, it would be easy to push it out of the wheelbarrow. So take it easy while mixing it. You will see:)

Do not mix Vermiculite based insulation in a cement mixer as the mixer is destroying the Vermiculite granular particles (page with images plus extra reading on vermiculite insulation.)

Thickness of this refractory insulation slab layer should be between 3" to 4" (75mm to 100mm) which is sufficient for the small surface a family sized wood fired oven has. When you make the floor insulating slab; transfer it from your wheelbarrow into place, spread it on the whole surface, and tap the mix on the top to make it more solid. This tapping doesn't have to be done with an insulation applied on the top of the oven because that one just sits there on the dense cooking part. With the insulation that goes under the concrete slab for the oven, lite tapping is required, because the oven is heavy. Till it sets the surface will feel soft like a mulch. But as it dries it also becomes hard.

The same 5:1 makes it light in weight concrete also. Floors are cast out of this mix in high raise buildings to lower the weight of the whole building down. However builders use mostly Perlite instead of vermiculite because as a building material Perlite is brittle. As a insulation in wood fired ovens both Vermiculite and Perlite perform very much the same way.

I hope you find the **thermal insulation** information above useful.