

# Study of structural materials based on boron and barium enriched concrete and geopolymers to be used as shielding components

Francesco Grazzi, CNR-ISC, Italy

Gilberto Artioli, Università di Padova, Italy

Contact: [francesco.grazzi@isc.cnr.it](mailto:francesco.grazzi@isc.cnr.it)

## Aims of the project:

- Study and characterization of boron enriched structural materials to be used as shielding components at ESS
- Investigation on materials of interest
- Determination of their availability
- Preparation of test samples of mortar, concrete, geopolymeric mixtures
- Mechanical characterization
- Neutron transmission characterization
- Neutron scattering characterization

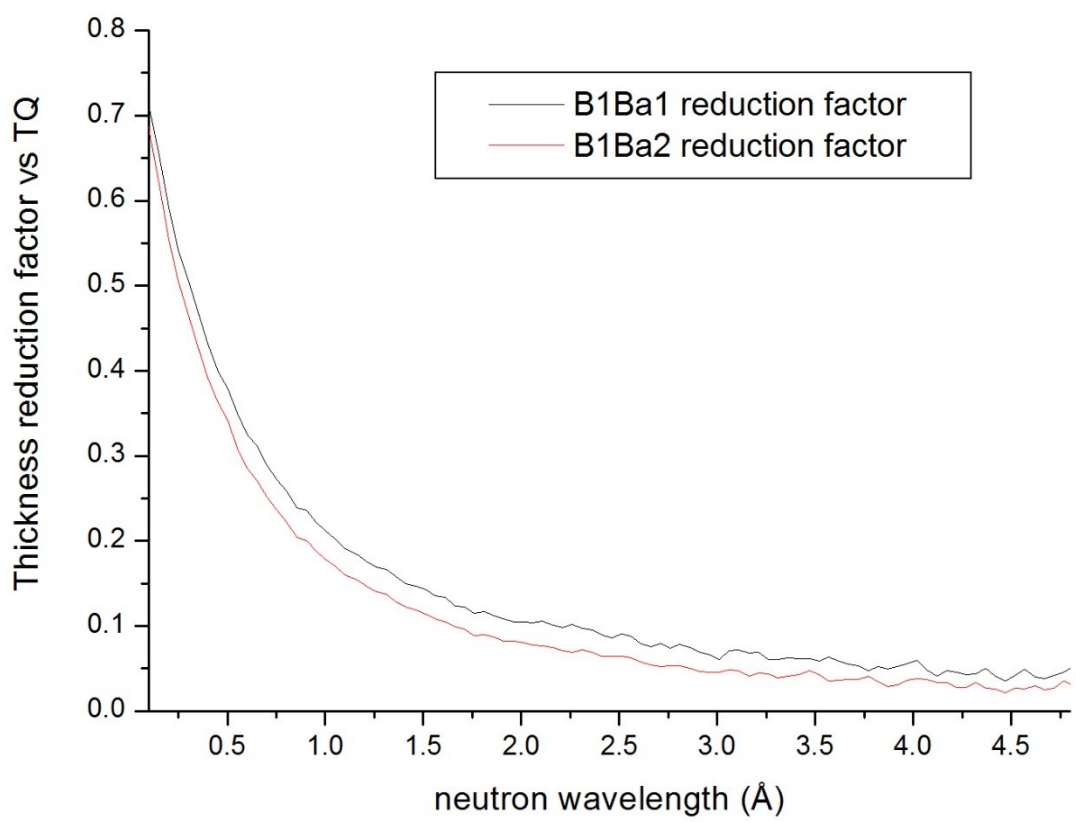
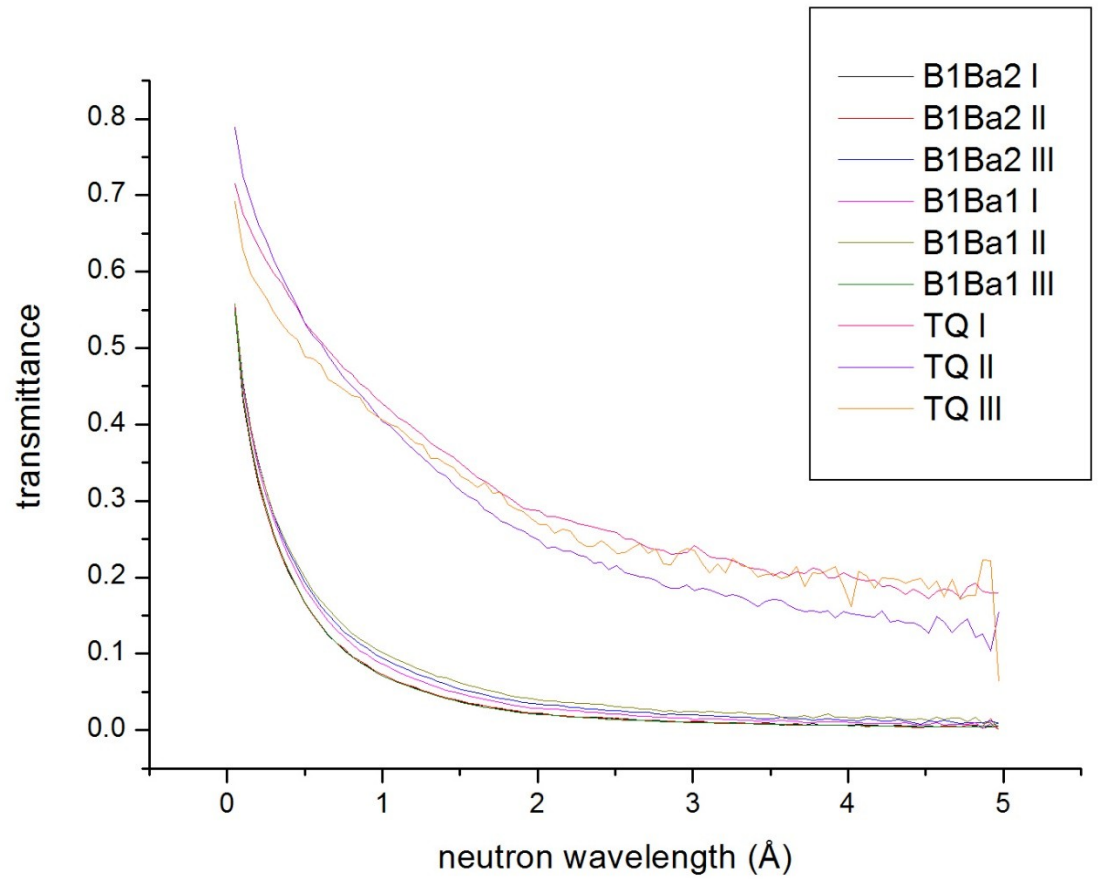
## Details on materials

- Identified boron rich mineral for neutron shielding: **colemanite**
  - available suppliers
  - scalable economy
  - reasonably low cost material
  - Good boron concentration
- Determination of colemanite grain size to minimize mechanical detrimental effects
- Addition of Ba rich mineral as gamma shielding (no negative mechanical effects)
- Preparation of boron enriched **mortar** and of boron and barium enriched **concrete**
- Testing and preparation of non Portland binders: **Geopolymers**
- Mechanical testing of the whole set of samples

# Neutron (and gamma) shielding measurements

## Time of flight transmission measurements

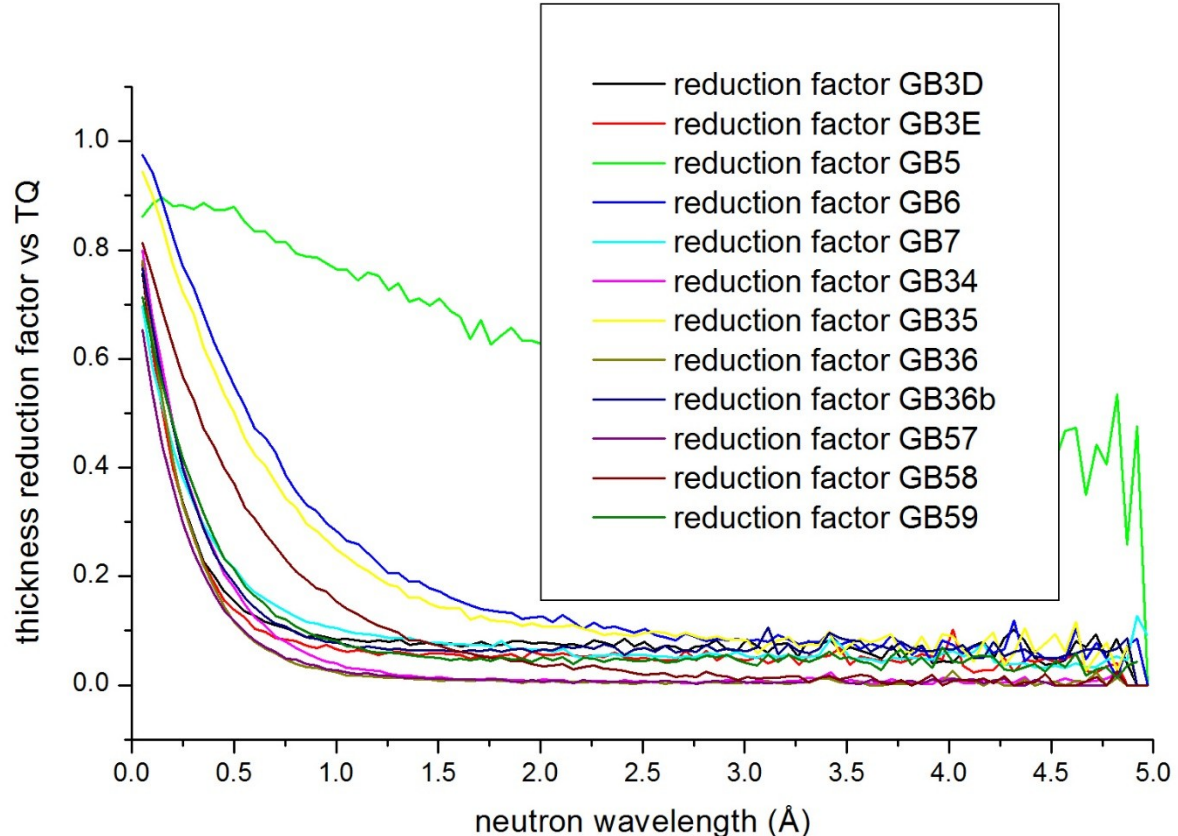
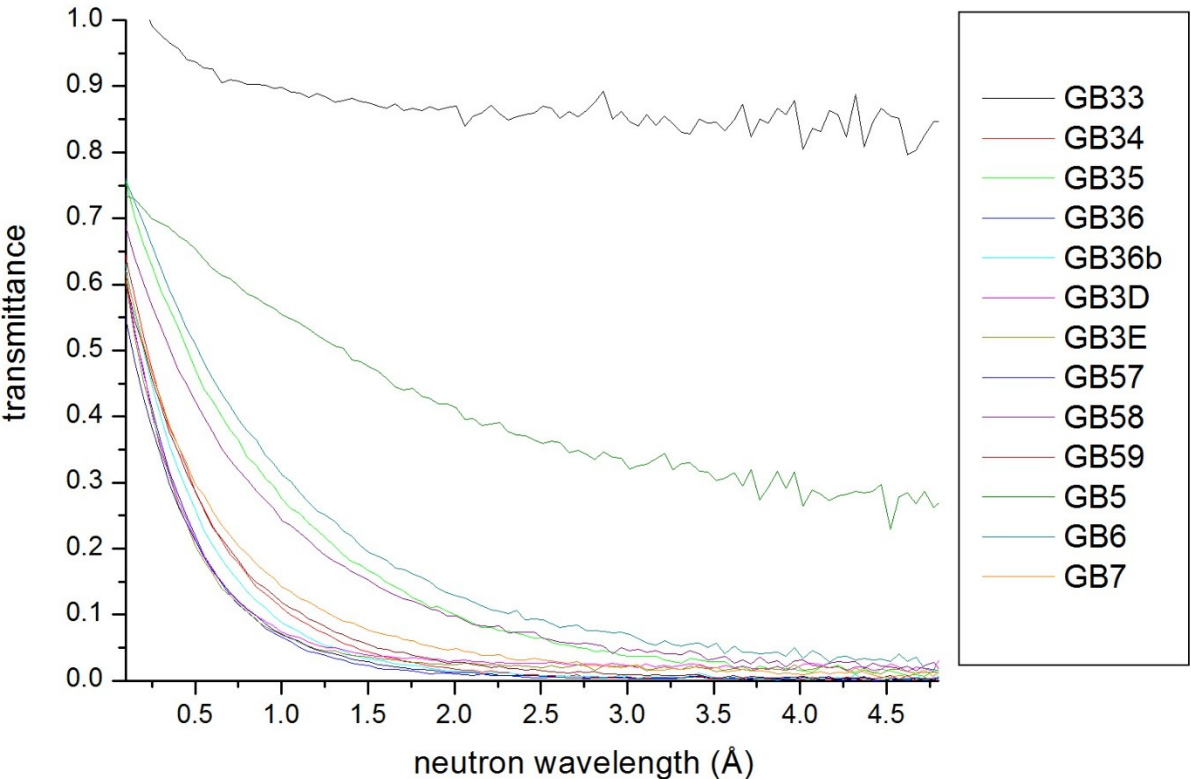
Concrete results: transmittance and thickness reduction factor respect to Portland



# Neutron (and gamma) shielding measurements

## Time of flight transmission measurements

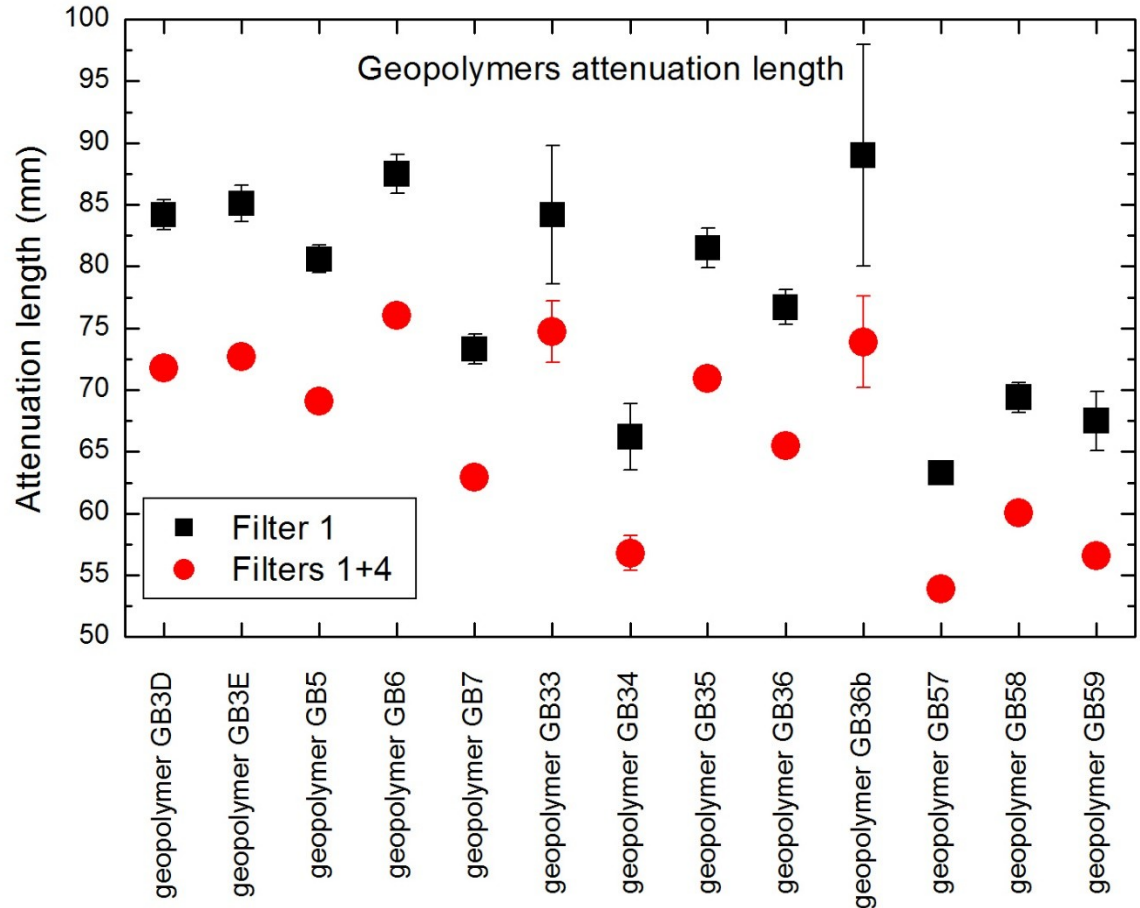
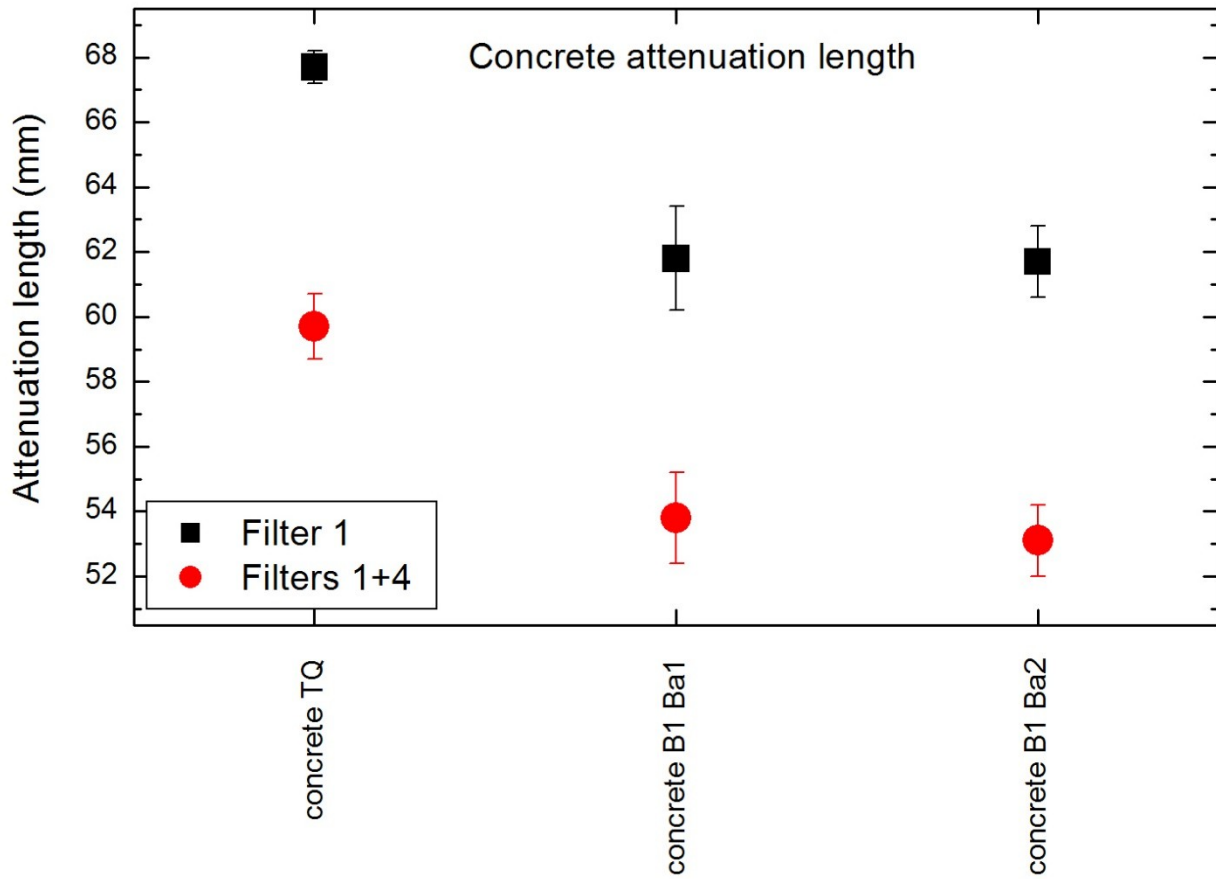
Geopolymers results: transmittance and thickness reduction factor respect to standard mortar



# Neutron (and gamma) shielding measurements

High energy neutrons and gammas transmission measurements

Concrete and geopolymers results: 1/e attenuation length (mm), filter 1 (n+), filters 1+4 (n)



# Structural Testing

