material was recognized in the construction sector. "The international interest is big" – Koenders is happy with that. He has made agreement with entrepreneurs and also researchers of Spain, France, Austria, Great Britain UE sponsors.

Exist materials from the geopolymers is metakeolin – a heat treated form of kaolin clay. With 600°C kaolin changes its structure, becomes reactive and hardens out quickly in mixing process. Nevertheless the heat-treatment of kaolin needs also much energy.

Kaolin contains in contrast to limestone no bound CO_2 that in burning process is expelled. And in burning much lower temperature is necessary than with cement burning which works positively on the CO_2 balance. Geopolymer on the basis of metakaolin retain with the processing otherwise. So these become liquid when stirred and then turn to gel like substance. With agitation or shaking these become liquid. The activation solution causes to that a certain stickiness/viscosity of the substance and renders difficult the peeling off of building components.

Geopolymers become concrete and cement in bigger standard replace when they exhibit the similar consistency – says Koenders. With his team he tests therefore different prescriptions in order to improve the handling of kaolin which contains ironoxide and other foreign materials, turns out to be suitable and over and above cost effective.

Also fly ashes from flue gas or vulcanizing trash can be mixed together. So its abundance of alkaline metals is favourable. So the concentrations of alkaline activation solution get reduced, which reduces the cost. In focus of the researchers stand to the admixtures which lends the substitute concrete new properties.

Still cement is valid as worldwide most frequently used building material, nevertheless the geopolymers can make it cease to remain in the rank for special application. It has also the advantages. These are more stable in heat than concrete whose incorporated water builds in case of fire a steam pressure which leads to the cracks and blank spaces. These are resistance against chemicals, as these do not contain lime, which in contact with acids and aggressive substance dissolve. Already after one day the geopolymers develop similar compressive strength. These effect quick removal of shuttering and become suitable or mass production of precast components.

At present the researchers at Darmstadt experiment with chemically resistant sewage pipes of geopolymers. These are certainly at present still costlier than those made of cement or concrete – says Koenders, however, their durability if rightly prepared make them by all means of higher price.

Anil Kumar Ghosh

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Editorial

Dark Matter: on the way to Discovery

Particle Physics: The most sensitive detector in the whole world is located deep under the Italian Massive Gran Sasso. In cosmos the known materials constitute only 5%. Planets and stars are built of these. Astronomical observations, however, suggest that in universe there must be much more of an unknown material which takes away so far the direct proof. This so called dark matter – the real ruler is the universe as it holds together the galaxies.

What do they consist of is one of the biggest riddles of physics. This may be the elementary particle as is the oxiom is to look for a needle in a hay stack as said by Manfred Lindner, director of Max Planck Institute for Nuclear Physics, Heidelberg. We come to an end from that hundred thousands of these tiny particles stream through the surface of a thumbnail per second. The reality that these with the atoms of normal materials make reciprocal action and so leave behind identifiable traces, but must be extremely tiny otherwise we could have already found them. How should therefore, one prove the ghost particle? For that one international research consortium with German participation has constructed the world's most sensitive detector Xenon IT. The experiment is brought down into Italian Gran Sasso Massive in order to shield the detector from disturbing influence like cosmic radiation. A huge thermoscan filled with 3.2 ton fluid ultrapure rare gas Xenon is kept in -95°C. The thermoscan sticks to a tank with 750m^3 extremely pure water which protects it from radioactive radiation. Because it is everywhere also in stone deep under the earth. Just near the detector in a three-storeyed building the Xenon gas is prepared in a neat expanse superlative laboratory about 1.5 Km deep underneath the mountain.

In order to find the seldom occurring reciprocal actions of dark material elementary particles in the detector, we need big quantities of detector material and an extremely high radioactive purity otherwise we would not have chance to see the right signals under the disturbing signals as said by Christian Weinheimer, atom physicist at the university of Münster. A technical challenge as objects entirely without radioactivity does not exist. Tiny traces are there everywhere in metals, in the walls of the laboratory and our own body. We place everything to that, in order to reduce these impurities, as far as possible.

For the construction of instruments therefore came only the painstakingly investigated materials in question. Only so it was successful to make the centre of Xenon IT to one of the cleanest spaces of the universe. This is the assumption to find the extremely rare signals of dark matter, emphasizes Weinheimer.

The researchers measure extremely feeble light and electric charge signals out of which they reconstruct the place of reciprocal actions in detector apart from the released energy. 248 highly sensible light sensors take over the evidence which is equally brought down to the huge thermoscan. These sensors register every flash of light caused by individual photons.

Exactly two suspicious flashes of light generate when one of the dark matter particles is captured by detector material. The collision with a xenon atom produces the first one – while with that an electric charge carrier is released it comes immediately to a further signal. The evaluation criteria are vigorous. Only results in the centre of the detector are credited. The outward xenon builds up additional screening against the remaining radioactivity in material.

Still the researchers have not discovered any trace of dark matter, while they have taken over straight first the regular measuring operation. But they are optimistic "with the detector we have an excellent position in the race for discovering the dark matter Lindner, the atom physicist is convinced.

Anil Kumar Ghosh

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