**Future generation of tokomaks with super-high magnetic fields**

“Fusion Energy Plant supplying electricity to the grid is feasible right now with the current technologies available”, claim some leading physicists from Massachusetts Institute of Technology (MIT) in the USA.

In their paper “ARC: A compact, high-field fusion nuclear science facility and demonstration power plant with demountable magnets” by D. G. Whyte and his team published in ELSEVIER in November 2015, they present a revolutionary new design of a small and inexpensive tokomak reactor which can be a science facility and a prototype nuclear fusion plant as well. They point out that we already have all the technologies available right now to build that reactor.

The tokomak is a magnetic confinement device for producing controlled thermonuclear fusion power by nuclear fusion. Nuclear fusion is a nuclear reaction in which two atomic nuclei collide at very high speed to form a new nucleus. As a result of the reaction fusion energy is realised. Fusion power is an unlimited source of inexpensive and clean energy, which one day could make redundant the whole multi-trillion gas and oil industry.

The idea of magnetic confinement fusion has been known since the 1950’s, when first tokomak was built. Although decades have passed, billions of dollars spent on research and dozens of tokomaks built, physicists were unsuccessful in harnessing fusion energy. The scientific devices were too big and too expensive but ineffective at the reaching required parameters in plasma temperature and density for burning plasma. Some physicists were so frustrated that they confessed “they were stuck” with the idea of nuclear fusion. They explained that the main reason for their misfortune was the inability of copper magnets to generate high magnetic fields.

However recent breakthroughs in research and development of high temperature superconducting (HTS) materials change the game and give us a new hope. A new type of wire made with high temperature superconducting materials now is commercially available. This wire has a shape of tape and is made from rare-earth barium copper oxide **(**REBCO**)**, called REBCO tapes and are manufactured by Superpower Ltd. Furthermore, Mag Lab at MIT university in the USA using REBCO tapes completed magnetic coils generating super-high magnetic field of 32 Tesla, which is many times greater copper magnets.

“If we replace copper magnets in tokomaks by magnets made with high-temperature superconductive materials, we will be able to generate much higher magnetic fields and make tokomaks smaller, less expensive and much more efficient”, promises professor Dennis Whyte, the author of the paper. He explains that the higher the magnetic field, the smaller the tokomak size is required for burning hydrogen plasma.

Some students were so inspired by his idea that they decided to build a smaller tokomak reactor with HTS magnets on their own. They hope this tokomak will be a proof-concept of a leading edge technology, attract funding and accelerate fusion energy research. In general, Prof Whyte’s idea was enthusiastically adopted in academic circles and made us believe that fusion energy is attainable within reach.