Czochralski method in Poland after 100 years

Materials for solid state lasers: yttrium aluminium garnet single crystals ($Y_3Al_5O_{12}$ - YAG) doped with rare earths elements as active media for crystalline lasers; YAG doped with Cr, Co or V for passive Q-switching elements; Ti – doped sapphire single crystals (Al_2O_3: Ti) for tunable lasers.

High pressure Czochralski equipment with GaAs (gallium arsenide) single crystal boule.

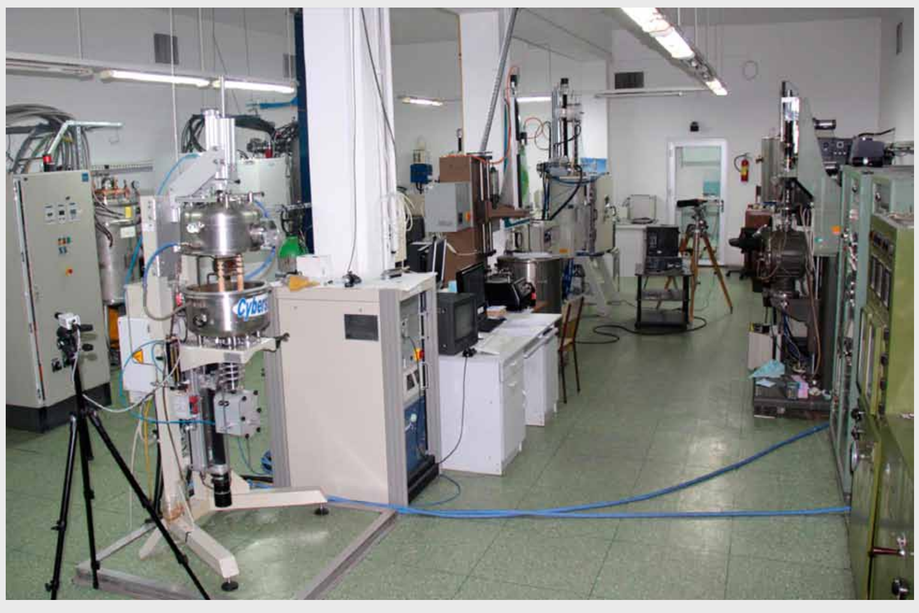
In the middle of the 20th century the brilliant Czochralski's method of growing single crystal metals was applied by physicists working on semiconductor devices (diodes, transistors, the first integrated circuits), which soon supplanted vacuum tubes. Single crystals of silicon (today not only of silicon) became the basis for the construction of the majority of integrated circuits (micro-chips), and, as a consequence, of electronic devices or elements. These, in turn, are omnipresent, starting with small and large computers through steering systems of various machines and vehicles to mobile phones, toys and music postcards.

An important aspect of Czochralski method is that the obtained crystals are of unusual purity: in such materials only one different element may be found among several billion identical molecules.

Almost a century after its creation, Czochralski method of crystal growth is still intensively used and creatively developed, and he himself continues to be the most-cited Polish scientist.

Poland is an important contributor to the current scientific research into and development of technologies based on Czochralski method. A leading role is played here by the Institute of Electronic Materials Technology in Warsaw – an institution employing almost 200 scientists, engineers and technicians. The Institute produces in particular new materials for electronics, photonics and optoelectronics,as well as materials generating, storing and transmitting electric energy. The basis for these is not only silicon, but also other substances, both pure and with some inclusions which ensure special features of materials.

Weeks of growing allow a silicon monocristal to reach human height and few dozen kilograms. One can manage to fit even 100 000 microchips on wafers cut out of the cristal



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The equipment for single crystal growth of oxide materials (Oxypuller 05-03 made by Cyberstar – France)