

伊賀 文俊 (Fumitoshi Iga)

所属 (Domain) 理学野物理学領域 (Domain of Physics)

・ 博士後期課程量子線科学専攻 (Major in Quantum Beam Science)

● 研究テーマ (Research theme)

① 高圧合成による機能性物質開発

(Novel functional material development by high pressure synthesis)

② 希土類ホウ化物近藤絶縁体におけるエキゾチック物性の解明

(Research on exotic physical properties of Kondo insulator in rare-earth borides)

① 常圧では作製できない物質は、高圧環境下では作製可能な場合がある。地球深部、地下600kmでは圧力は25万気圧にも達するが、そのような環境を再現し、新規の化合物を開発を目指す装置が右の写真である。これまで未作製の GdB_{12} や SmB_{12} などの新しい希土類ホウ化物の合成に成功してきた。現在は、さらに軽希土類のホウ化物や新しい有機化合物の高圧合成にも挑戦中で、新機能性材料開発と物性評価を進めている。

Sometimes we can obtain the materials which can be produced only under high-pressure circumstance. The pressure reaches 250,000 atm at 600 km deepness of the earth. The right picture is the equipment which can realize such environment. We have succeeded in synthesis of novel rare-earth borides such as GdB_{12} and SmB_{12} which cannot be produced up to date. At present we are challenging the high-pressure synthesis of other lighter rare earth borides and new organic compounds.



We have succeeded in synthesis of novel rare-earth borides such as GdB_{12} and SmB_{12} which cannot be produced up to date. At present we are challenging the high-pressure synthesis of other lighter rare earth borides and new organic compounds.



② 希土類ホウ化物の純良単結晶を光集中加熱炉で浮遊帯域溶融法 (FZ法) により育成し、その物性研究を行っている。次世代の高速デバイスとして期待されるトポロジカル近藤絶縁体 SmB_6 と YbB_{12} の大型純良単結晶のバルクの磁性や伝導、熱物性のほか最近注目されている表面物性などを測定して強相関電子状態の解明を進めている。近年磁場下で金属でしか示しえない量子振動が絶縁体の YbB_{12} の電気抵抗の磁場依存性で見つかり、その発生機構が世界的に注目を集めている。

Pure and large single crystals have been grown by the floating-zone method using the 4-xenon-lamp image furnace and their physical properties have been evaluated. SmB_6 and YbB_{12} called Topological Kondo Insulator are taken much attention as the candidates of future-high response device. Their bulk properties such magnetism, transport and thermal properties and surface-state are evaluated. Recently quantum oscillation phenomenon which is observed only in metallic compounds under high magnetic field has been discovered in semiconductor YbB_{12} . This phenomenon is also taken attention as a very serious academic problem among the world because this is concern the definition of both metal and insulator.

キーワード (Keyword)

専門分野 (Specialized Field)

共同研究可能技術 (Possible Technology of Cooperative research)

関連論文・特許情報 website
(Related articles・patent information)

研究設備 (Research Facility)

研究室URL (Lab. URL)

E-mail

高圧合成 (High pressure synthesis) 近藤絶縁体 (Kondo insulator) 純良単結晶育成 (Growth of pure single crystal)

磁性物理学 (Magnetic Physics)

光加熱FZ法による純良単結晶育成及び高圧合成による機能性材料開発 (Single crystal growth by FZ-method using an image furnace & functional material development by high pressure synthesis)

<https://info.ibaraki.ac.jp/Profiles/23/0002235/profile.html>

高圧合成装置 (High pressure synthesis equipment) 4楕円イメージ炉 (4-xenon lamp image furnace)

Under construction

fumitoshi.iga.sciphys@vc.ibaraki.ac.jp