

Research Highlights

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New EDLT-DAC Provides Insights Into High-Pressure Environments

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19 Mar, 2021

MANA researchers have devised a way to control the carrier density in various materials under high pressure by combining an electric double-layer transistor (EDLT) with a diamond anvil cell (DAC) and applying the resulting EDLT-DAC to thin films.



Research into extremely high pressure environments is unlocking phenomena that are inaccessible at ambient pressures. One recent success was the discovery of high transition-temperature superconductivity (HTS) in hydrides using a DAC. HTS in hydrides had been predicted but never actually produced.

EDLTs have been used recently to introduce carriers into various materials, which has led to a number of interesting phenomena being observed. Forming an EDLT on a sample surface induces a large number of carriers around the sample surface. The EDLT structure and the DAC are the most widely used tools for tuning physical properties in materials; combining them multiplies their usefulness.

In their research, the MANA team developed an EDLT-DAC and applied it to a thin film of bismuth. They then exerted high pressure using the DAC and observed the electrical field effect in the condensed material to verify the characteristics of the EDLT-DAC.

They found that the sample exhibited a prominent response upon the application of the electric

field and pressure, as expected. The electric double layer was stabilized by the pressure, which they hope will contribute to the development of devices such as new types of transistors in the field of applied physics.

Because their EDLT-DAC can tune the carrier density of the materials under high pressure, the researchers believe it will help accelerate the exploration of physical phenomena that have never been studied before.

This research was carried out by [Yoshihiko Takano](#) (MANA Principal Investigator, Group Leader, Nano Frontier Superconducting Materials Group) and his collaborators.

Reference

“Demonstration of Electric Double Layer Gating Under High Pressure by the Development of Field-Effect Diamond Anvil Cell”

Author: Shintaro Adachi, Ryo Matsumoto, Sayaka Yamamoto, Takafumi D. Yamamoto, [Kensei Terashima](#), Yoshito Saito, Miren Esparza Echevarria, Pedro Baptista de Castro, Peng Song, Suguru Iwasaki, [Hiroyuki Takeya](#), [Yoshihiko Takano](#)

Journal: Applied Physics Letters 116, 223506 (2020) [25 December 2019]

DOI : [10.1063/5.0004973](https://doi.org/10.1063/5.0004973)

(MANA E-BULLETIN)

<https://www.nims.go.jp/mana/ebulletin/>

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