

| | | | |
|----------|---|-----|-------------------------|
| 氏名 | 謝 天順 | | |
| 学位（専攻分野） | 博士（工学） | | |
| 学位記番号 | 千大院理工博甲第工 178 号 | | |
| 学位記授与の日付 | 令和 6 年 9 月 3 0 日 | | |
| 学位記授与の要件 | 学位規則第 4 条第 1 項該当 | | |
| 学位論文題目 | Laser irradiation effect on MoTe ₂ and its transistor application (MoTe ₂ に対するレーザー照射効果とトランジスタ応用) | | |
| 論文審査委員 | (主査) | 教授： | 音 賢一 |
| | (副査) | 教授： | KRUEGER PETER 教授： 宮本 克彦 |
| | | 教授： | 青木 伸之 |

論 文 内 容 の 要 旨

MoTe₂ is a Transition Metal Dichalcogenide (TMDC) material demonstrating outstanding potential for utilization in next-generation channel material. The purpose of this study is to systematically explore the effects of laser irradiation on MoTe₂ and its application in MoTe₂ electronic devices. This study first verified that the residue formed by appropriately high-intensity laser irradiation on 2H-MoTe₂ crystal in the atmosphere is a mixture of MoO₂ and Te. Next, different from laser irradiation in the atmosphere, it was found that MoTe₂ crystal transform from the 2H semiconductor phase to another metallic phase of 1T, which is different from the 1T' phase, under appropriately high-intensity laser irradiation in vacuum. By employing this technique, a 1T/2H/1T polymorphic homojunction has been achieved. Then, the contact properties of 1T-contacted 2H-MoTe₂-FET were investigated by fabricating metal electrodes on the 1T surface. In the vicinity of the directly irradiated area, this study confirmed that laser irradiation in vacuum and the atmosphere induces heavy n-type and p-type doping effects. Therefore, after heavy doping via laser irradiation in the contact area of MoTe₂-FET during the fabrication process, relatively low Schottky barriers and contact resistances were obtained. Additionally, since the contact doping method can also control the polarity of MoTe₂-FET, this study realized the operation of MoTe₂ CMOS inverter with a high gain. TFETs have significant potential in low-power device applications. This study used laser-induced doping to achieve the operation of both n-TFET and p-TFET on a single MoTe₂ crystal. In addition, n-TFET and p-TFET are fabricated on the same substrate and combined into an inverter. It successfully achieves signal inversion, representing the first demonstration of a 2D-CTFET inverter in the world.