

A Graphene Hall Element and CMOS monolithic Integrated Circuit

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It is well known that graphene, as a zero bandgap material, has low switching ratio and poor saturation output characteristics, which is difficult to replace the mainstream CMOS process in digital and analog integrated circuits. But as a sensor material, graphene has the characteristics of high sensitivity and high stability. The combination of graphene sensor and silicon-based CMOS circuit can give full play to their respective advantages. In previous work, graphene is mainly used as interconnect material to integrate with CMOS circuits. In this paper, a low temperature preparation method of graphene ($< 110^{\circ}\text{C}$) is explored, and a CMOS readout circuit including a programmable gain amplifier(PGA) and an Sigma-Delta analog-to-digital converter is designed, which greatly improves the performance of graphene hall element(GHE) IC chip. The Graphene Hall Element and CMOS (GHEC) IC chip is fabricated with $0.18\mu\text{m}$ CMOS technology. The test results show that the low-frequency noise of the chip is well suppressed at 3.3V supply voltage. Its relative sensitivity of current and voltage mode is 134000 V/AT and 10 V/VT respectively, which can be applied in the field of speed measurement and alternating current detection.

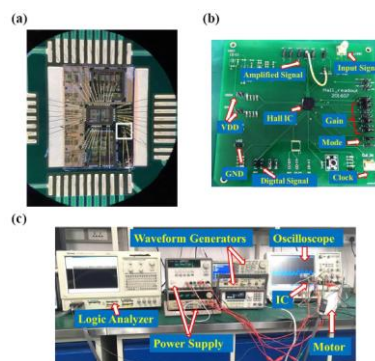


Fig.1 GHEC IC chip test system (a) GHEC monolithic IC; (b) Test board; (c) Test platform

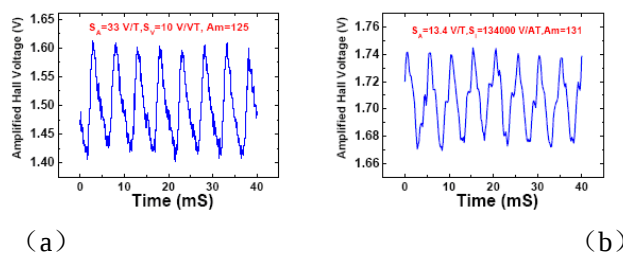


Fig.2 GHEC IC chip output in time domain (a) voltage mode; (b) current mode

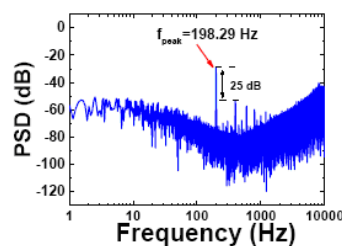


Fig.3 Signal-to-noise ratio of GHEC IC chip