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Experimental results of disruption mitigation with SMBI and MGI on HL-2A

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Dedicated experiments have been carried out with Supersonic Molecular Beam Injection (SMBI) combined with the massive gas injection (MGI) on HL-2A. The behaviors of runaway currents in MGI induced disruptions have been investigated. Long-lasting RE plateau is achieved after argon injection by MGI even at B_T = 1.28 T, much lower than previous B_T threshold found in other tokamaks. It was found that argon injection can cause the generation of runaways carrying up to 30% of the initial plasma current.

Moreover, the runaway current caused by argon injection with MGI was successfully suppressed by SMBI with a number of injected atoms of about 1.0×10^{21}. Light gases, such as helium, are selected in this experiment for its high efficiency in increasing the density. These experiments suggest that SMBI might be viable for runaway suppression in future tokamaks.

In addition, a toroidal alfvén eignmode (TAE) was observed during disruptions deliberately triggered by MGI of argon. This mode occurs at the beginning of the current quench and lasts about 1-2 ms, which plays a favorable role in scattering runaway electrons, and hence, limiting the strength of runaway beam.

In summary, mitigation of runaway current was successfully implemented with SMBI during disruptions deliberately triggered by MGI of argon. These results bring important insights to the suppression of runaway for further simulations and extrapolations to larger devices like ITER.