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High-power tests of the compactly HOM-damped TM020-cavities for a next generation light source

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Coupled-bunch instability arising from impedances of higher-order modes (HOMs) in RF cavities is a problem to be suppressed in high-current, low-emittance electron storage rings. As a countermeasure against the problem, we have developed a compactly HOM-damped cavity resonating in the TM020-mode at a frequency of 509 MHz. The damping structure compromises circumferential and shallow slots in the cavity inner-wall and ferrites inside the slots. Since the slots are along the magnetic nodes of the TM020 mode, the ferrites absorb only RF powers of the HOMs. The cavity has a shunt impedance of 6.8 MΩ and generates an accelerating voltage of 825 kV at a 100 kW input. The cavity has a slot-type input coupler with a variable-length stub to match its coupling degree with change in beam loading during the operation. The prototype cavity demonstrated satisfactory performance in high-power operation up to 120 kW. Therefore, this innovative cavity is about to be utilized for beam acceleration in the new 3 GeV synchrotron radiation facility, NanoTerasu. We report on the performance of four fabricated cavities, problems and countermeasures experienced in their high-power tests.

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