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A cryogenic dielectric pulse compressor

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Efforts aimed at developing klystron parameters have made significant progress in recent years. However, the ultimate parameter list of connected pulse compressors (PCs) has been given insufficient attention. We propose to develop a new high efficiency, high power gain pulse compressor based on the use of a dielectric storage resonator (100% dielectric filling factor) that is operated at a cryogenic temperature (77K). It is well known that, at cryogenic temperatures, a copper cavity can gain a much higher Q factor. However, at cryogenic temperatures, the RF loss tangent of some dielectric materials also decreases substantially (tan☒ 10-9 for Sapphire at 10 K). This inspires our effort to develop dielectric resonators for PCs with an intrinsic quality factor, Q0, that is several orders of magnitude higher than the Q0 for all metallic resonators at room temperature, and at least twice as high as for cryogenic copper cavities. In addition, the dielectric storage cavity can make the PC system more compact and lower their cost. The concern for multipactor occurring on the dielectric surfaces can be successfully addressed by special RF design and coatings like the DLC (diamond-like carbon) coating. We anticipate improving the parameters of the well-known SLED and SLED-II PCs. We consider both a passive PC (switched with a fast change of the klystron's phase) as well as an active PC (which requires a fast RF switch).

Footnotes

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