Simulation on Optimization of Nano-Antenna Length of Ring-Resonator-Type Device for Heat-Assisted Magnetic Recording

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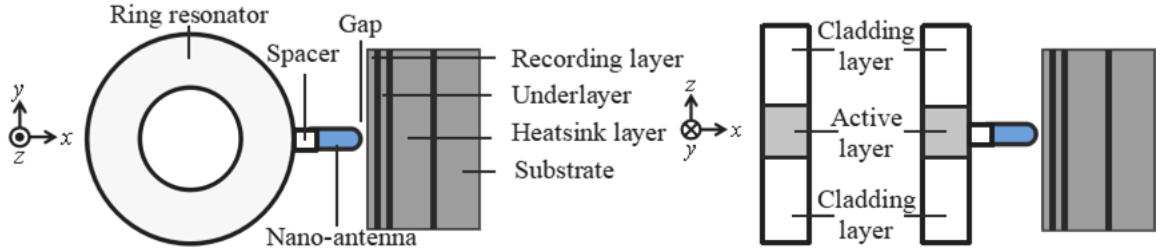
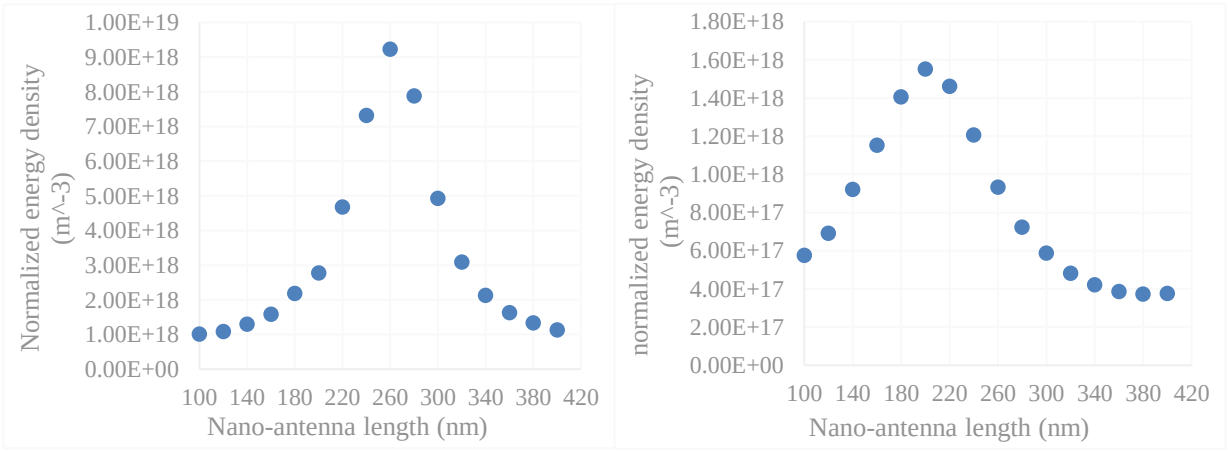
【Introduction】Heat-assisted magnetic recording is a technology using a laser light to heat the magnetic recording medium to reduce its coercivity during recording. In order to meet the demand of high recording density, the size of each recorded mark needs to be reduced. Therefore, a near-field transducer (NFT) is introduced to break the diffraction limit. There is a requirement for the energy of the near-field light. The authors' team has proposed a new device[1)] in which a nano-antenna as the NFT is attached to a ring resonator as a light source. In this study, the nano-antenna length was optimized to increase the energy density. 【Methods】The structure of the device and recording medium is shown in Fig. 1[2)]. A gold nano-antenna is attached to a GaAs ring resonator, whose active layer contains quantum dots with a laser gain at about 1050 nm. The energy density at the nano-antenna tip was calculated when the nano-antenna length was varied from 100 to 400 nm. 【Results】The relationship between the energy density at the nano-antenna tip and nano-antenna length is shown in Fig. 2. There was a peak of energy density when the nano-antenna length was 260 and 200 nm without and with the recording medium, respectively. Therefore, the nano-antenna length must be optimized considering the influence of the recording medium.



(a) Plane view (b) Side view

Fig. 1. Structure of proposed device and recording medium.



(a) Without recording medium (b) With recording medium

Fig. 2. Relationship between energy density at nano-antenna tip and nano-antenna length.

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1) R. Katayama et al., Jpn. J. Appl. Phys., **58**, SKKB01 (2019).

2) R. Katayama et al., Opt. Rev., **27**, 432 (2020).