increased by surface treatment or by increasing the number of defect states and deep recombination centers in the bulk material.

Inherently linked to the behaviour of the resonance in the far field (as measured with extinction efficiencies), the near-field intensity can be enhanced on ultrafast time scales (few ps) as shown in Fig. 7. Figure 7(b) and 7(c) display the electric field intensity enhancement, in a horizontal cross section of the antennas at their middle height, of the antenna in the OFF (b) and ON (c) states as calculated by 3D FDTD. Before the arrival of the pump pulse (OFF state), the field enhancement is very low and almost constant at 1. After the arrival of the pump pulse, the increase in field intensity enhancement is up to a factor of 10^4 at the tip of the antennas. The field is mainly squeezed in the gap of the antennas into an area of about 1600 μm^3. This represents a field concentration of about 10^5 times compared to λ^3 where λ is the wavelength of the THz radiation. We note that although extreme field enhancement can be locally achieved in the gap of the bowtie antenna, the overall field enhancement is in accordance with the Q factor of the resonances.

7. Conclusion

In summary, this article proposes the use of semiconductors for the excitation of localized surface plasmon polaritons at THz frequencies. By means of bowtie antennas made of silicon, ultrafast control of the resonances over a range of extinction efficiencies up to 6 is achieved within few picoseconds. The experimental demonstration of the excitability and ultrafast active control of plasmonic resonances of silicon antennas at THz frequencies paves the way towards a wide range of novel fundamental and applied research in sensing, spectroscopy, and non-linear interactions.

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