Plasmonic hybridization and dynamic color pixels

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Surface plasmons (SPs) are collective oscillations of free electrons excited at an interface between metal and dielectric materials by incident light. The plasmonics is a potential candidate of future technologies due to its fast response and high sensitivity in a small volume. In this presentation, two main topics are introduced. One is a plasmonic hybridization in terms of fundamental study. The other is a cavity-aperture as a dynamic color pixel in terms of plasmonic application research.

While a specific mode or state of various kinds of SPs has been mainly studied in past, the scope of the research tends to be expanded to the hybrid of different modes or states of SPs in these days. The hybridization is important because it presents a general principle to design metallic nanostructures and to predict their resonant properties. In particular, the hybrid between propagating surface plasmons (PSPs) and localized surface plasmons (LSPs) can induce an anti-crossing phenomenon between two characteristic energy-momentum dispersion bands of PSPs and LSPs. This phenomenon is a useful tool to control energy bands in band engineering.

In general, color filters are very useful to express various colorful images in displays, and one pixel should have three sub-pixels of red, green, and blue colors for displays. Although many display industries have tried to improve the resolution and clarity of display images, they have not overcome the intrinsic resolution problem from the sub-pixel system. Therefore, we propose new structure and method to change the color in one pixel. We named it cavity-aperture because it is comprised of a cavity and a metal nanoaperture. The cavity-aperture can simultaneously control the color and intensity of transmitted light in a single pixel. We expect that the cavity-apertures have a potential for dynamic color pixels, micro-imaging system, and multiplexed sensors.