Electronic Supplementary Material (ESI) for Nanoscale Advances.

Supporting information for Linewidth narrowing of aluminum breathing plasmon resonances in Bragg gratings decorated nanodisks

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I. CL SPECTRA IN NEAR-INFRARED

For CL spectra simulation in the visible and near-infrared wavelengths (350 -1500 nm), a peak was found around 1062 nm when the Al Bragg grating decorated nanodisk (BGDN) was excited by a vertical dipole (see Fig. S1(a)). Figure S1(b) shows the E_z field distribution of the structure around 1062 nm, a dipolar like charge distribution appears for the inner aluminum disk.

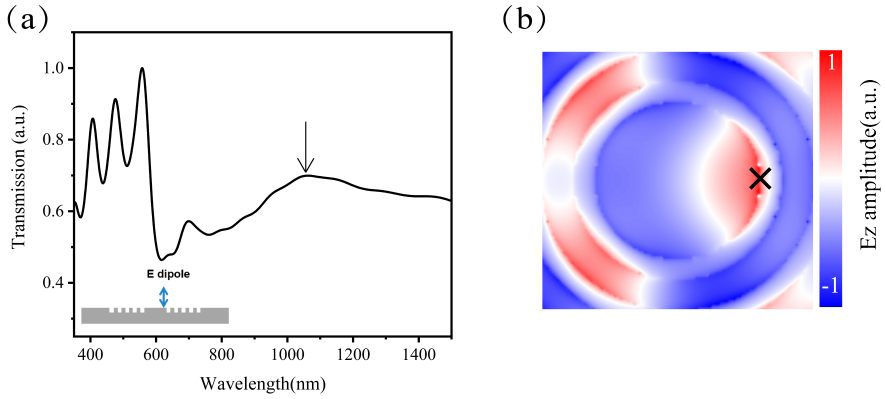

FIG. S1: (a) Calculated CL spectra from the Al BGDN under edge excitation with a vertical electric dipole.The inset shows the electric diople position. (b) Calculated E_z field distributions at the CL peak position around 1062 nm. The black cross indicates the position of the electrical dipole.

II. THE NARROWING EFFECT

The full width at half maxima (FWHM) as a function of distance d, period T, duty cycle a are shown in Fig. S2(a)-(c). By manipulating the distance between the Bragg grating and disk from 50 to 150 nm, the FWHM decreases with the increasing distance. We also changed the duty cycle a and the period T of the Bragg grating. However, in these two cases, the variation of the FWHM is not obvious. And Fig. S2(d) shows that the narrowing effect not only appears in the breathing mode, but also the quadrupole mode, hexapole mode and so on.

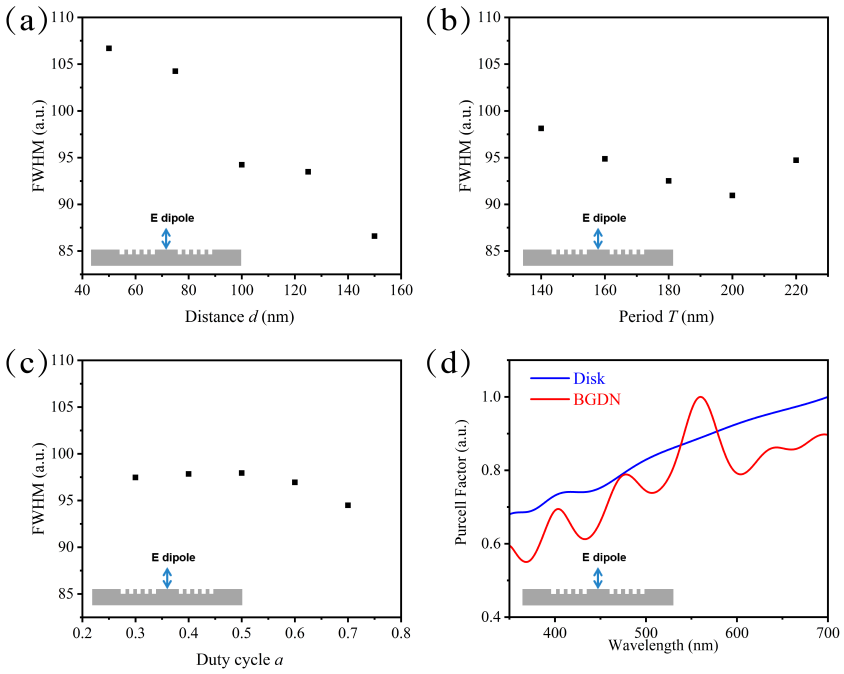

FIG. S2: The FWHM of calculated CL spectra under center excitation from different (a) distance d (between disk and the Bragg grating); (b) period T; (c) duty cycle a; (d) Calculated CL spectra under edge excitation from the disk edge(blue) and BGDN (red). The insets show the electric diople position respectively.

III. DETAILED MAGNETIC DIPOLE MODAL

In the magnetic modal, the BGDN is described as a central nanodisk and a series of in-plane magnetic dipoles which distributed evenly along the circumference at the groove center. And a vertical electric dipole is used to excite the plasmon mode in the central disk. The detailed dipole model is shown in Fig. S3.

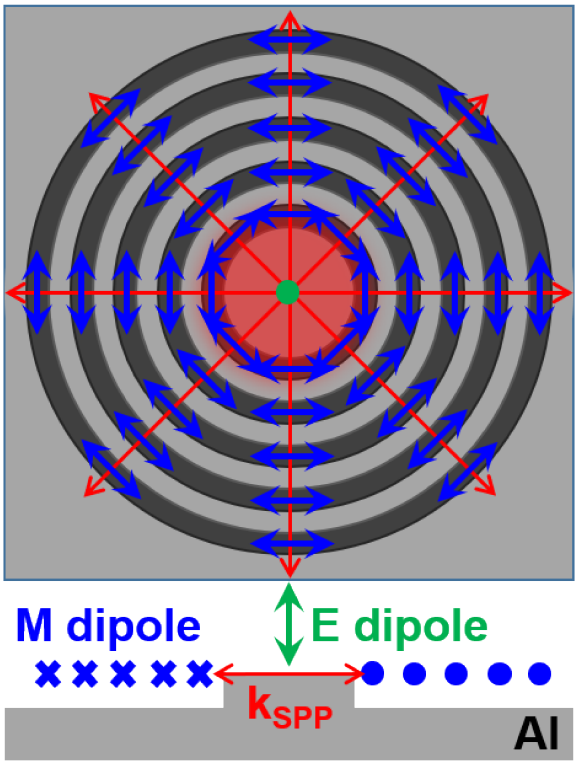

FIG. S3: Schematic illustration of the magnetic dipole model (top and side views). The green dot (arrows in side view) represents the electric dipole position and orientation for plasmon excitation, the red arrows represent the direction of plasmon propagation, and the blue arrows (dots in side view) represent the magnetic dipole positions and orientations.