断面図が欲しい。

なぜこんなデザイン？ (out-couplerは幅が広い？)

condition, as summarized in Ref.[6],

$$k_{SPPgr} = k_0 sin\theta + \frac{2n\pi}{d}, \tag{1}$$

where k_{SPPgr} and $k_0 = 2\pi/\lambda_0$ is the wave vector of SPPs on a grating and propagating light, λ_0 is the wavelength of the propagating light, θ is incident angle, d is grating pitch, and n is a positive or negative integer.

In this study, SPPs were excited by incident light with a grating (in-coupler), to propagate along a waveguide until they reach another grating (out-coupler) to radiate. The out-coupled power emitted from the out-coupler is considered to be proportional to the power of the SPPs that flow into the out-coupler, in the assumption that the efficiency of SPP-light coupling is steady among all couplers, while maintaining the incident light in power. It follows that, the out-coupled light decreases at the same rate to the SPPs, as the distance between the in-coupler and out-coupler increases. We calculated the distance that the out-coupled power falls to 1/e, depending the length of the waveguides: that is, equivalent to the propagation length of the SPPs.

※1

半角スペース

Fig. 1(A) shows schematic of experimental setup. A CO_2 laser was used ~~for~~ as a mid-infrared light source generating linearly polarized light at wavelength of 10.6μm. ~~The power was controlled by Pulse Width Modulation in radio frequency.~~ P-polarized light was incident ~~into~~ onto the in-coupler at a certain angle that fulfills Eq. 1 with n=1, being loosely collimated by a spherical mirror with R=400mm. The out-coupled light was collected by a power meter using a spherical mirror with R=150mm. An aperture was arranged in front of the power meter, ~~being optical conjugate with~~ the out-coupler. ~~In the~~ The sample ~~which is attached with a xyz-stage on a rotational table.~~ was We also used a He-Ne laser ~~for~~ as a guide laser, to be ~~coupled~~ collinearly overlapped with the mid-infrared light ~~passing through a CaF substrate which behaves as a partial mirror in both visible and mid-infrared ranges.~~

Italic

a radius of curvature

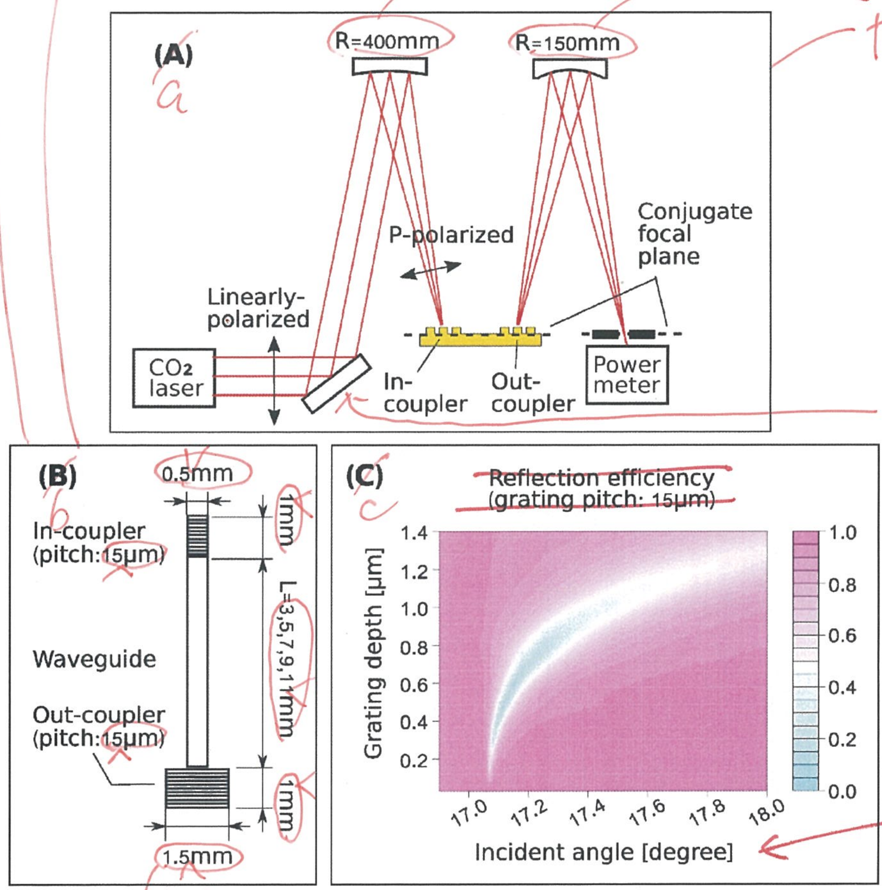
placed at the conjugate point of

to a rotational and xyz-translational stage.

Annealing was applied to the sample twice on a hotplate in Argon atmosphere, for increasing grain size on the surface of the waveguides[7]. In the first annealing process, the sample was heated at 600°C for 20min, and gradually cooled on the hotplate ~~at~~ to room temperature. In the second annealing, the sample was heated at 700°C for 16min, ~~cooling down~~ and cooled in the same way.

スペース不要

AFMなどで粗さ



R400

R150

Au Mirror? or CaF2 window

垂直入射がゼロですね？

数字がmmに比べて小さい。

Figure 1: (A) Schematic of experimental setup. (B) Gratings and waveguide design. (C) Reflection efficiency on a grating with pitch 15μm and duty cycle 50%, calculated by RCWA.

3. Experiment

スペース空きすぎ

まず、デバイスの大まかな構造を説明する。

3 Sample

We designed ~~multiple~~ several SPP waveguides with ~~lengths ranging from 3 to 11mm with a 2mm step, sandwiched by gratings with length 1.0mm as shown in Fig. 1(B). A width of the waveguide and the in-coupler is 0.5mm, while~~ the out-coupler has a width of 1.5mm. Both of the in-coupler and out-coupler have a rectangular profile with pitch of 15μm ~~in~~ with a duty cycle 50%. ~~Each of the waveguides is parallelly aligned with a spacing~~ 1.5mm. The waveguides and swelling part of gratings are ~~optimized~~ set to be 800nm higher than the gold base, ~~as illustrated bellow.~~ because of the following reasons.

a width of 0.5mm and varied lengths of 3, 5, 7, 9, and 11 mm

The waveguides are terminated by the in-coupler / out-coupler gratings of 1-mm length, respectively

Grating depth is reported ~~as~~ to be significantly influential for the SPP-light coupling efficiency[6][8]. To estimate the optimized grating depth for the strongest SPP-light coupling ~~that results in high signal-to-noise ratio of the optical experiment~~, we conducted a nu-

※1

The time averaged power of the CO_2 laser was controlled by the duty ratio of the power modulation in radio frequency. The input power to the in-coupler was typically ○ mW (the duty ratio was typically 0.4?).

In order to modify the morphology of the Au film, the sample was annealed twice with a hotplate in Argon atmosphere [7].