

ABSTRACT

An exposure apparatus uses a dioptric projection optical system easy to manufacture and a mask of an ordinary size, and is able to effect a projection exposure in a high resolution with high throughput, while
5 securing a large effective image-side numerical aperture through the intervention of a high-refractive-index medium in an optical path between the projection optical system and a photosensitive substrate. The exposure apparatus is configured to effect a projection exposure of a reduced image of a pattern formed on the mask (R), through the
10 projection optical system (PL) onto the photosensitive substrate (W). Where a refractive index of an atmosphere in an optical path of the projection optical system is 1, the optical path between the projection optical system and the photosensitive substrate is filled with a medium having the refractive index larger than 1.1. The projection optical
15 system has still exposure regions substantially smaller than one shot-area to be formed on the photosensitive substrate, and repeats a projection exposure in a portion of the shot-area more than once in the projection exposure in the shot-area.