US 20240237373A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0237373 A1**

SHIOMI et al. (43) **Pub. Date: Jul. 11, 2024**

(54) **SOLID-STATE IMAGING ELEMENT**

(71) Applicants: **SONY GROUP CORPORATION**, Tokyo (JP); **SONY SEMICONDUCTOR SOLUTIONS CORPORATION**, Kanagawa (JP)

(72) Inventors: **Michinori SHIOMI**, Tokyo (JP); **Syuuiti TAKIZAWA**, Tokyo (JP); **Yuta OKABE**, Kanagawa (JP); **Osamu ENOKI**, Kanagawa (JP); **Yosuke SAITO**, Kanagawa (JP)

(21) Appl. No.: **18/289,172**

(22) PCT Filed: **Apr. 27, 2022**

(86) PCT No.: **PCT/JP2022/019141**

§ 371 (c)(1),
(2) Date: **Nov. 1, 2023**

(30) **Foreign Application Priority Data**

May 7, 2021 (JP) 2021-079316

Publication Classification

(51) **Int. Cl.**
H10K 39/32 (2006.01)

(52) **U.S. Cl.**
CPC ***H10K 39/32*** (2023.02)

(57) **ABSTRACT**

A solid-state imaging element according to an embodiment of the present disclosure includes: a photoelectric conversion layer including first semiconductor nanoparticles; and a buffer layer including second semiconductor nanoparticles. A p-n junction surface is formed at an interface between the photoelectric conversion layer and the buffer layer. A product of a carrier concentration and a film thickness of the buffer layer is larger than a product of a carrier concentration of the photoelectric conversion layer and a diffusion length of a minority carrier, and a thickness of a depletion region formed in the photoelectric conversion layer is maximized.