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(54) **METHODS OF MANUFACTURING A
PEROVSKITE OPTOELECTRONIC DEVICE**

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(57) **ABSTRACT**

A method of manufacturing an optoelectronic device includes the steps of: providing a substrate; depositing a first electrode layer on the substrate; depositing a first charge-carrier selective layer with a thickness less than 5 nm situated directly on the first electrode layer; depositing insulating silicon oxide nanoparticles directly on the first charge-carrier selective layer, the particles having a diameter between 10 nm and 100 nm; depositing a perovskite-based semiconductor layer on the first charge-carrier selective layer and on the insulating silicon oxide nanoparticles, the perovskite-based semiconductor layer being in intimate contact with both the first charge-carrier selective layer and the insulating silicon oxide nanoparticles; depositing a second charge-carrier selective layer on the perovskite-based semiconductor layer; depositing a second electrode layer on the second charge-carrier selective layer.

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