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(54) **METHODS FOR MAKING PEROVSKITE SOLAR CELLS HAVING IMPROVED HOLE-TRANSPORT LAYERS**

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(58) **Field of Classification Search**

None

See application file for complete search history.

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(57) **ABSTRACT**

An aspect of the present disclosure is a device that includes a first layer that includes a hole-transport material and an acid, where the first layer has a conductivity between 20 μS/cm and 500 μS/cm. In some embodiments of the present disclosure, the first layer may absorb light having a wavelength between 400 nm and 600 nm. In some embodiments of the present disclosure, the hole-transport material may include at least one of 2,2',7,7'-tetrakis(N,N-di-p-methoxyphenylamine)-9,9'-spirobifluorene (spiro-OMeTAD), a derivative of spiro-OMeTAD, poly(triarylamine), poly(3-hexylthiophene), and/or N,N'-bis(3-methylphenyl)-N,N'-diphenylbenzidine.

22 Claims, 35 Drawing Sheets