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Double treated mixed acidic solution texture for crystalline silicon solar cells

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Saw damage of crystalline silicon wafer is unavoidable factor. Usually, alkali treatment for removing the damage has been carried out as the saw damage removal (SDR) process for priming the alkali texture. It usually takes lots of time and energy to remove the sawed damages for solar grade crystalline silicon wafers We implemented two different mixed acidic solution treatments to obtain the improved surface structure of silicon wafer without much sacrifice of the silicon wafer thickness. At the first step, the silicon wafer was dipped into the mixed acidic solution of $HF:HNO_3$=1:2 ration for polished surface and at the second step, it was dipped into the diluted mixed acidic solution of $HF:HNO_3:H_2O$=7:3:10 ratio for porous structure. This double treatment to the silicon wafer brought lower reflectance (25% to 6%) and longer carrier lifetime (0.15 μs to 0.39 μs) comparing to the bare poly-crystalline silicon wafer. With optimizing the concentration ratio and the dilution ratio, we can not only effectively substitute the time consuming process of SDR to some extent but also skip plasma enhanced chemical vapor deposition (PECVD) process. Moreover, to conduct alkali texture for pyramidal structure on silicon wafer surface, we can use only nitric acid rich solution of the mixed acidic solution treatment instead of implementing SDR.