INTRODUCTION
Isotropic, acidic texturing is an industrially compatible technique suitable for reducing the reflectance of solar cells made from multicrystalline silicon (mc-Si) wafers [1-4]. In order to investigate the acidic texturing process, as-cut mc-Si wafers have been etched in a range of different acidic mixtures. Thereafter, their structural and optical properties have been characterized.

EXPERIMENTAL
As-cut mc-Si wafers have been textured using a range of different acidic mixtures containing hydrofluoric (HF) and nitric acid (HNO₃), with either de-ionized water (H₂O (DI)), phosphoric acid (H₃PO₄) or sulfuric acid (H₂SO₄) added as diluents. The etching times have also been varied. Thereafter, the wafer surfaces have been characterized using optical and scanning electron microscopy, white light interferometry, profilometry and reflectance measurements.

RESULTS

DISCUSSION AND CONCLUSION
A range of different surface structures can be obtained when texturing as-cut mc-Si wafers in acidic mixtures. In the initial stages of the texturing process, the surface structure is determined by the saw damage. As the etching proceeds beyond this damaged layer, the surface structure gradually attains a bubble-like appearance, independent of the initial surface.

The reflectance reduction of a given texture is determined by the aspect ratio of the light trapping structures and by the fraction of the total surface area which is covered by these structures. In this work, reflectances from 15.0% towards values well in excess of 30% have been obtained without any anti-reflective coating. The lowest reflectances are obtained with crack-dominated textures while bubble-like textures with wide and shallow etch pits result in reflectances comparable with those of polished Si wafers.

The least reflective, crack-dominated textures are unsuitable for solar cell fabrication using conventional screen-printing technologies. More rounded textures with slightly higher reflectances can more easily be introduced into a solar cell production line.

REFERENCES