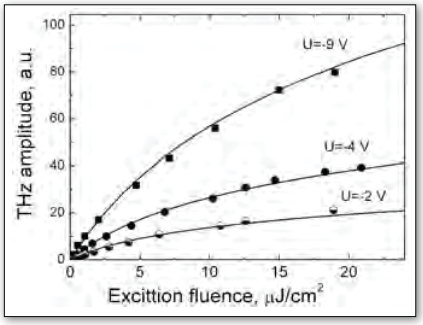
Passivated tunneling contacts for c-Si solar cells



◂ Dependencies of the THz amplitude on the excitation fluence at different bias voltages. The solid curves are results of calculations by the developed model with the following parameters: $m^e = 0.065m_0$, $m_h = 0.5m_0$, $\varepsilon = 12.9$, $\alpha_0 = 1.8\times10^4\ m^{-1}$ (electron and hole effective masses, dielectric constant and bulk optical absorption coefficient for $\hbar\omega_{ex} = 1.56$ eV, respectively). The initial electric field F_0 in the QWs was supposed to be equal to the averaged electric field in the structure part containing QWs.

bias under interband femtoseconds laser photoexcitation at room temperature. The detected THz radiation is attributed to the excitation of time-varying dipole moment induced by polarization of non-equilibrium electron–hole pairs in QWs. Noticeable sub-linearity in the dependence of THz amplitude on excitation density is observed. A theoretical model, which accounts for the dynamic screening of the electric field in wide GaAs QWs by nonequilibrium carriers, has been developed. The model describes well the properties of the observed THz signal. ■

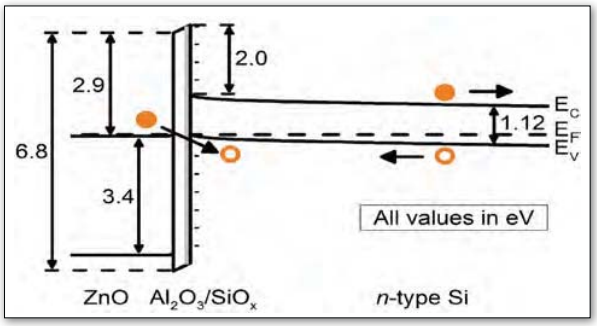
▮ **A.V. Andrianov**, **P.S. Alekseev**, **G.V. Klimko**, **S.V. Ivanov**, **V.L. Tscheglov**, **I.V. Sedova**, and **A.O. Zakhar'in**, 'Influence of dynamic screening effect on coherent terahertz radiation from biased GaAs/AlGaAs quantum wells', *Semicond. Sci. Technol.* **28**, 105012 (2013)

APPLIED PHYSICS

Passivated tunneling contacts for c-Si solar cells

Al_2O_3 nanolayers are well-known for their ability to reduce recombination losses at crystalline silicon surfaces, making Al_2O_3 an attractive material for passivation of the next-generation high efficiency solar cells. In this work, we try to take the application of Al_2O_3 one step further: when Al_2O_3 is deposited on n-type silicon, a high concentration of holes accumulates at the surface due to the high density of negative charges in the Al_2O_3. Consequently a *pn*-junction is formed which can replace the traditional front side *p*-doped region made by high temperature diffusion.

▾ Band diagram of the proposed novel front contact



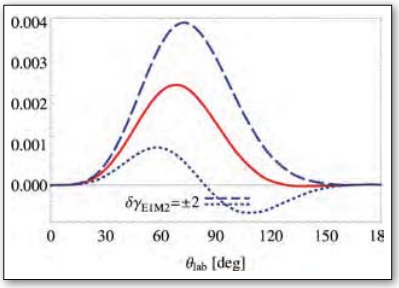
The idea presented in the article is to deposit a stack consisting of an Al_2O_3 and ZnO layer on the silicon. The holes separated from the electrons at the junction can tunnel through the Al_2O_3 into the transparent conductive ZnO where they are collected with minimal energy loss when the Al_2O_3 charge density and ZnO doping density are properly tailored. Using atomic layer deposition, it was demonstrated that Al_2O_3 and Al-doped ZnO films deposited with sub-nanometer precision can be used for this purpose with sufficiently high tunneling currents when the Al_2O_3 is about 1-2 nm thick. ■

▮ **D. Garcia-Alonso**, **S. Smit**, **S. Bordihn** and **W.M.M. Kessels**, 'Silicon passivation and tunneling contact formation by atomic layer deposited Al_2O_3/ZnO stacks', *Semicond. Sci. Technol.* **28**, 082002 (2013)

PARTICLE PHYSICS

Dissecting deuteron Compton scattering I

The electromagnetic polarisabilities of the nucleons characterise their responses to external fields. The simplest are the electric and magnetic polarisabilities that describe the induced dipole moments. For spin-1/2 particles there are also four spin polarisabilities, analogous to rotations of the polarisation of light by optically active media. The best experimental window on them is Compton scattering of photons, which has provided good determinations of the electric and magnetic polarisabilities of the proton. Future experiments with polarised protons will give access to its spin polarisabilities. In contrast, much less is known of about the neutron since it does not exist as a stable target. Nonetheless, its properties can be obtained from Compton scattering on light nuclei, most notably the deuteron -- a weakly bound proton and neutron. A new generation of experiments is planned to provide beams of polarised photons on targets of polarised deuterons. If the spins of the final particles are not observed, there are 18 independent observables. This work provides,



▴ Sensitivity of a double-polarisation-asymmetry observable to the E1-M2 spin polarisability.