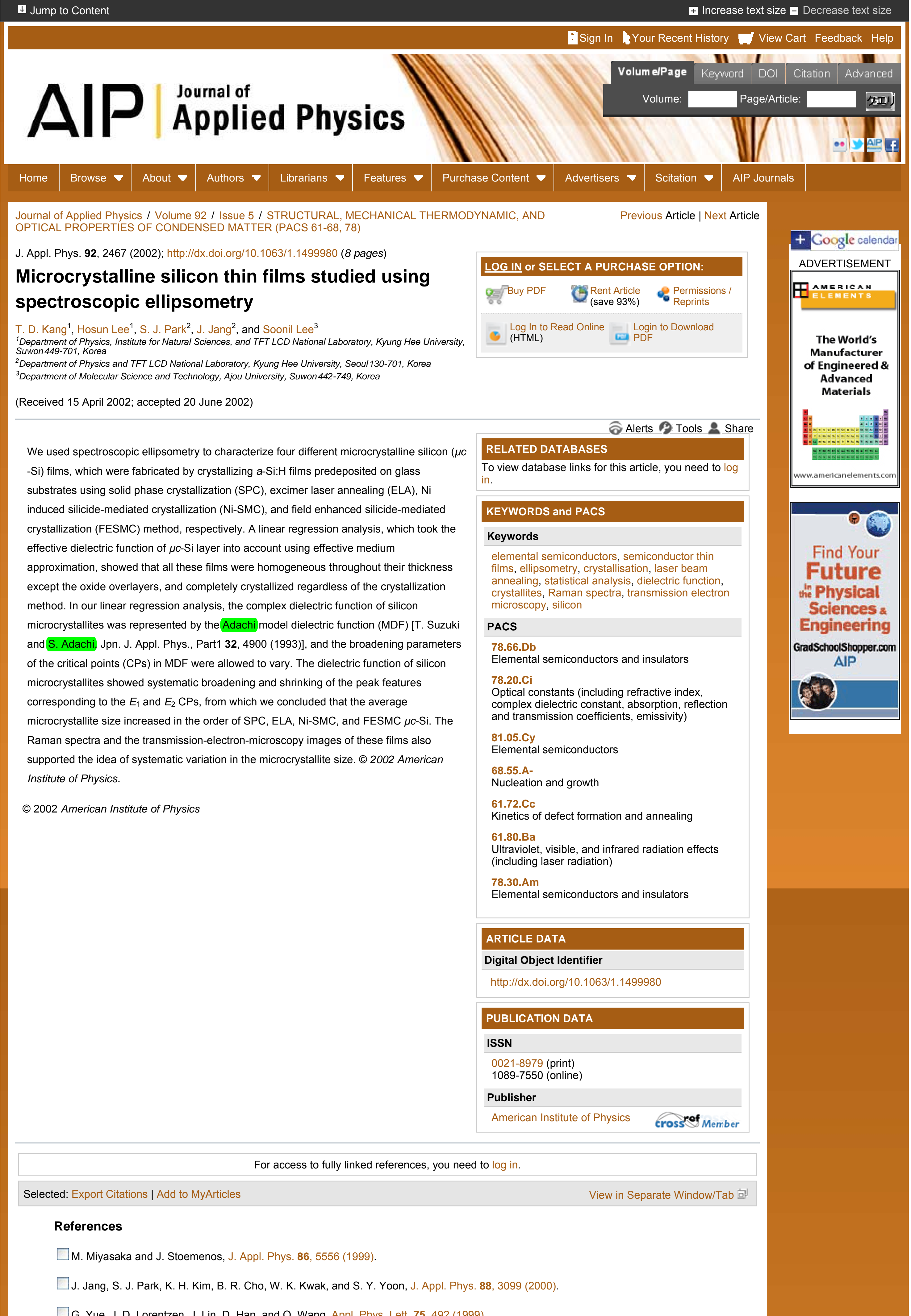

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Microcrystalline silicon thin films studied using spectroscopic ellipsometry

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We used spectroscopic ellipsometry to characterize four different microcrystalline silicon (μc-Si) films, which were fabricated by crystallizing *a*-Si:H films predeposited on glass substrates using solid phase crystallization (SPC), excimer laser annealing (ELA), Ni induced silicide-mediated crystallization (Ni-SMC), and field enhanced silicide-mediated crystallization (FESMC) method, respectively. A linear regression analysis, which took the effective dielectric function of μc-Si layer into account using effective medium approximation, showed that all these films were homogeneous throughout their thickness except the oxide overlayers, and completely crystallized regardless of the crystallization method. In our linear regression analysis, the complex dielectric function of silicon microcrystallites was represented by the Adachi model dielectric function (MDF) [T. Suzuki and S. Adachi, Jpn. J. Appl. Phys., Part1 **32**, 4900 (1993)], and the broadening parameters of the critical points (CPs) in MDF were allowed to vary. The dielectric function of silicon microcrystallites showed systematic broadening and shrinking of the peak features corresponding to the E_1 and E_2 CPs, from which we concluded that the average microcrystallite size increased in the order of SPC, ELA, Ni-SMC, and FESMC μc-Si. The Raman spectra and the transmission-electron-microscopy images of these films also supported the idea of systematic variation in the microcrystallite size. © *2002 American Institute of Physics.*

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Elemental semiconductors

68.55.A-
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