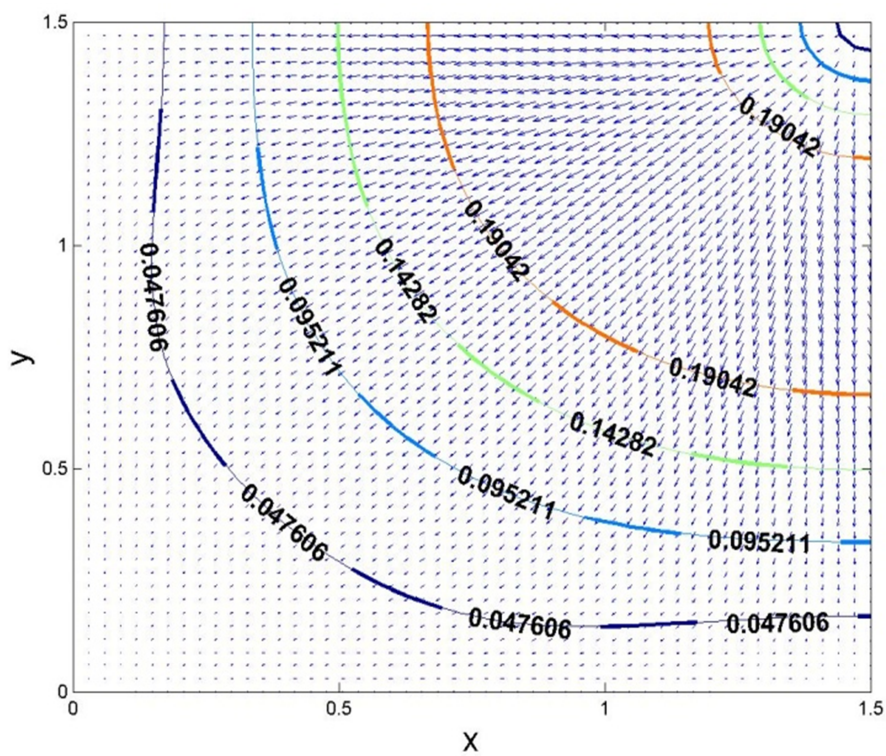**Supplementary Information**

Fig. 1. Vector plot and level curves of the force magnitude in pN on the *reference* particle, changing the relative position with respect to the facing layer unit cell; a=3nm, Rp=1nm and D=2.5nm, i.e. the facing lattice has its particles positioned in the lattice sites (0nm,0nm) (0nm,3nm) (3nm,0nm) (3nm,3nm). The vector plot is in logarithmic scale. Only one quarter of a unit cell is represented: (0,0) is the lattice site; (1.5,1.5) is the cell centre
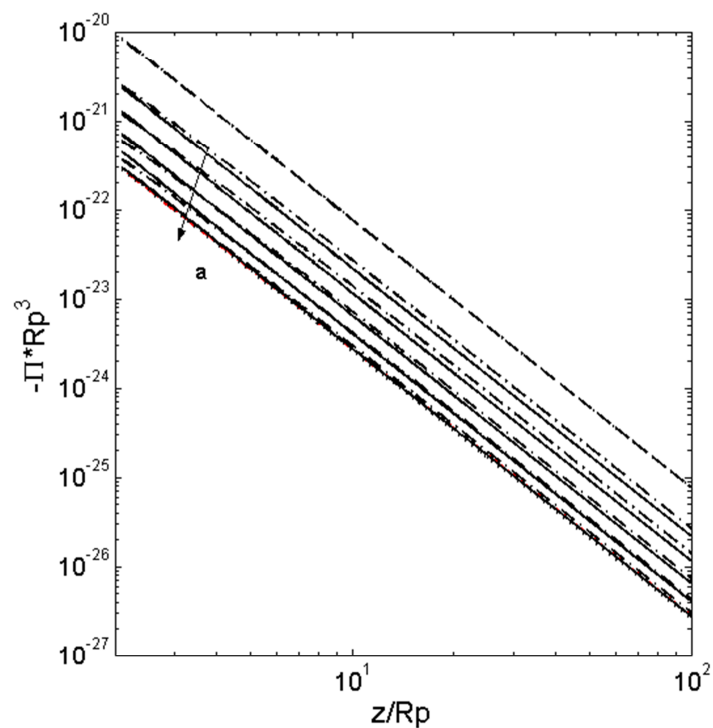
Fig. 2. Π (expressed in J) between two half spaces of PBd interacting across void, with dielectric particles as inclusions arranged in an SC lattice, a = [4Rp; 3Rp; 2.4Rp] and ε_{p3} = 6. System without inclusions (dotted curves); two half spaces with ε_{p3} = 6 interacting across void (dashed curves). The solid curves are obtained using the EMT method; the dashdotted curves are obtained using the proposed approach.
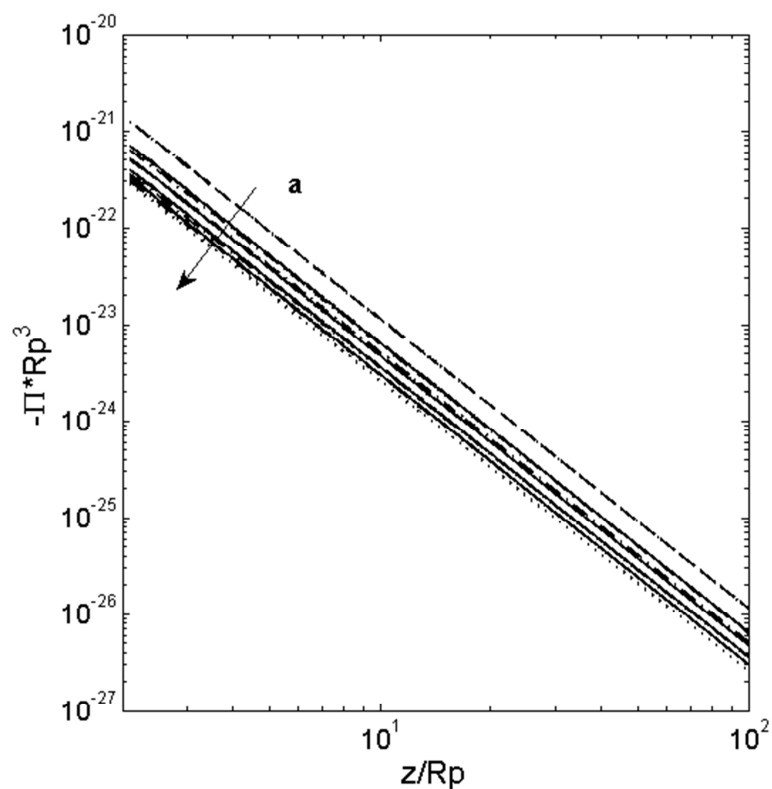
Fig. 3. Π (expressed in J) of two PBd infinite half spaces, interacting across void, with dielectric particles as inclusions arranged in an SC lattice, a = [4Rp; 3Rp; 2.4Rp], and ε_{p2} = 2 (solid curves). System without inclusions (dotted curves); two infinite half spaces with ε_{p2} = 2 in void (dashed curves). The solid curves are obtained using the EMT approach; the dashdotted curves are obtained using the proposed approach.
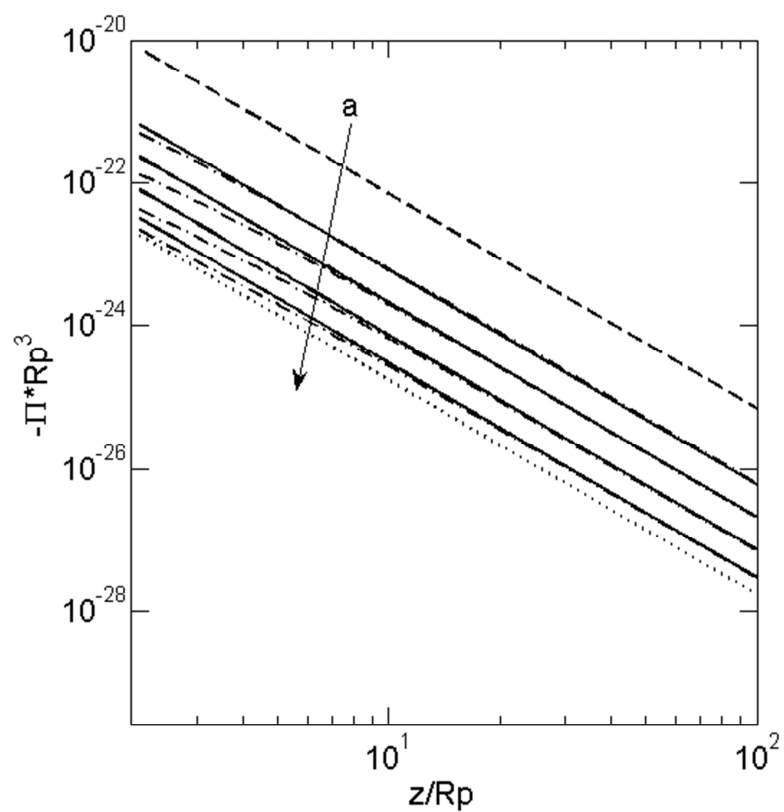
Fig. 4. Π (expressed in J) for two PBd infinite half spaces with dielectric particles as inclusions interacting across PDMS. The inclusions are arranged in an SC lattice, a = [4Rp; 3Rp; 2.4Rp]. System without inclusions (dotted curves), two infinite half spaces with ε_{p3} = 6 interacting across PDMS (dashed curves). The solid curves are obtained using the EMT approach; the dashdotted curves are obtained using the proposed approach.
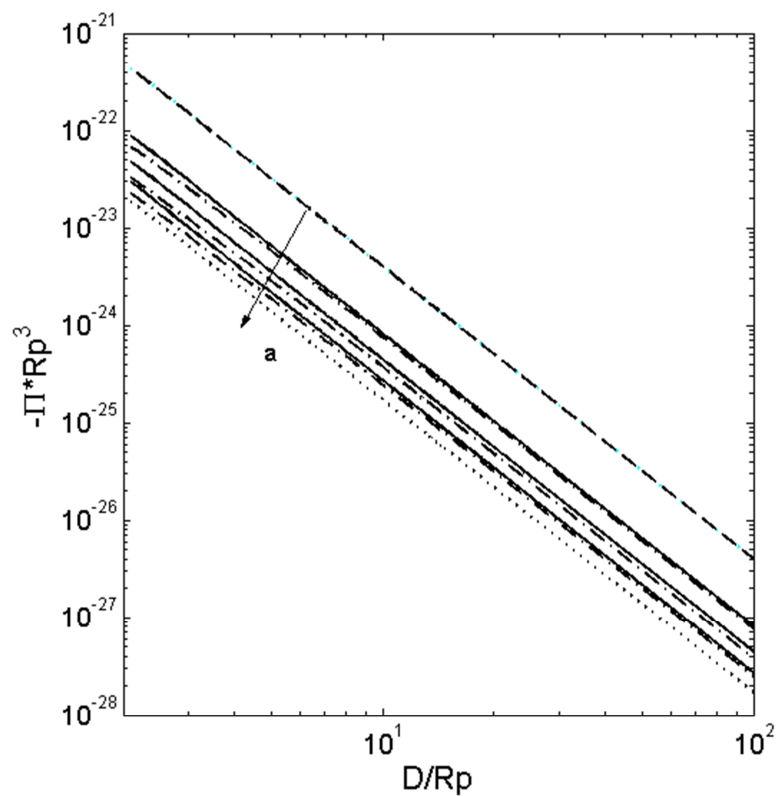
Fig. 5. Π (expressed in J) for two PBd infinite half spaces interacting across PDMS, with dielectric particles as inclusions arranged in an SC lattice, a = [4Rp; 3Rp; 2.4Rp], ε_{p2} = 2 (solid curves); system without inclusions (dotted curves); two infinite half spaces with ε_{p2} = 2 interacting across PDMS (dashed curves). The solid curves are obtained using the EMT approach, the dashdotted curves are obtained using the proposed approach.
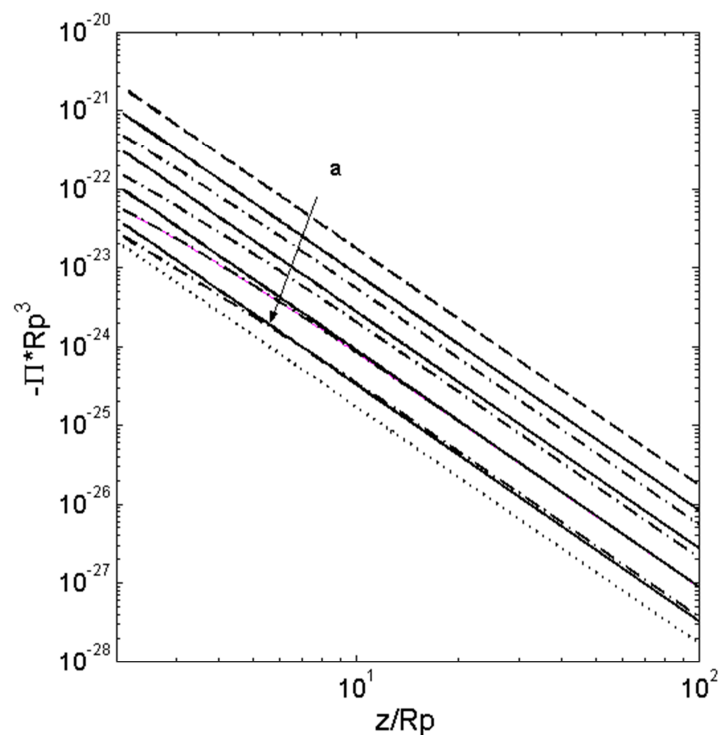
Fig. 6. Π (expressed in J) of two PBd infinite half spaces interacting across PDMS, with Au particles inclusions arranged in an SC lattice, a = [6Rp; 4Rp; 3Rp; 2.4Rp] (solid curves); polymeric system with no inclusions (dotted curves), two infinite gold half spaces interacting across PDMS (dashed curves). $A_{Au/PBd/Au} = 2.99 \times 10^{-19}\,J$ was evaluated with the Bruminger method, $A_{Au/PDMS/PBd} = 9.69 \times 10^{-20}\,J$, was determined as a fitting parameter. The black solid curves are obtained using the EMT approach, the dashdotted curves are obtained using the proposed approach.