Lipid domain growth and shape changes as a function of temperature in binary lipid mixtures visualized by atomic force microscopy.

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Lipid domain structures of varying geometries, sizes and lifetimes are expected to occur at different temperatures within the gel/fluid coexistence region for mixed lipid bilayer systems. We monitor domain formation and changes in domain shape and size as a function of temperature and time for DMPC/DSPC and DMPC/DEPC supported bilayers by AFM. We have deposited multiple lipid bilayers for the DMPC/DSPC mixture on the mica support. As a result the appearance of the domains formed in the top layer differs significantly from that of a single layer system. We propose that this is due to the reduced interactions between the mica and the top layer. With increase in temperature, an extensive small-scale gel/fluid phase separated structure is formed at a temperature close to the solidus phase line for the DMPC/DSPC mixture. As the temperature is raised into the gel/fluid coexistence region, larger lipid domains are formed. These domains have characteristic shapes with straight sides and 60° and 120° angle edges. Furthermore, we monitor in real time domain growth and coalescence events for both binary systems. The domain structures are interpreted in function of the phase diagrams for the binary mixtures.