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Dependence of evaporation of sessile drops on the deformation of soft substrates[1] YUHONG CHEN, DANIEL OREJON, PRASHANT VALLURI, VASILEIOS KOUTSOS, KHELLIL SEFIANE, Univ of Edinburgh — The global outbreak of COVID-19 has sparked recent interest on how sprayed/exhaled human droplets (potentially hosting the virus) dry on masks, clothes, and human skin, which can contribute to prevention and mitigation of infectious diseases. To date, the evaporation and lifetime of liquid droplets on flat rigid surfaces has been extensively studied and is well understood. However, flexible substrates such as textiles or human skin, which can deform due to capillary forces remains unexplored. Our experimental results show that the evaporation rate of water droplets on thin square membranes which deform due to capillary forces does not obey the conventional accepted diffusion model and being propostional to the perimeter predicting the evaporation rate is proportional to the length of contact line. The evaporation rate of drops in the present experiments is found to decrease linearly with the ratio of membrane side length to critical elastocapillary length once the membrane deformation is triggered. A possible interpretation of this result is that substrate deformation effectively alters the free surface area available for evaporation questioning the validity of the quasi-stationary mass diffusion transfer and the enhanced evaporation near the three phase contact line on deformable substrates. Solving theoretically the intricate physical aspects of the evaporation of droplets on significantly deformed substrates calls for this investigation.

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