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Anti-relaxation Surface Coatings for High-Density Alkali-Metal Magnetometers SCOTT SELTZER, MICHAEL ROMALIS, DAVID RAMPULLA, STEVEN BERNASEK, Princeton University, SANDRINE RIVILLON, YVES CHABAL, Rutgers University — Anti-relaxation surface coatings eliminate the need for buffer gas in alkali-metal vapor cells, giving larger signals due to narrower optical linewidths as well as reduced sensitivity to magnetic field gradients. Paraffin and other coatings presently used to reduce surface relaxation typically cannot operate at the high temperatures (T$>$ 100°C for cesium and T$>$ 150°C for potassium) required to obtain alkali-metal density suitable for spin-exchange relaxation free (SERF) magnetometers. We have found that octadecyltrichlorosilane (OTS) coating can allow approximately 2000 collisions of a potassium atom with the cell walls before depolarization. OTS can operate at temperatures of at least 150°C in the presence of potassium, and we have demonstrated a SERF magnetometer using an OTS-coated cell. We have also developed a reusable alkali vapor cell for simultaneous testing of multiple coated surfaces, and we are presently investigating several other coatings for chemical resistance to alkali metals, antirelaxation properties, and high-temperature operation. Development of a robust, high-temperature anti-relaxation surface coating would allow many experiments using very optically thick alkali vapor with a long spin relaxation time.

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