Supporting Information

Broadband Optical Absorber Based on Nano-patterned Metallic Glass Thin Films

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Figure S1 shows the XRD diffraction pattern of the as-sputtered CuZrAl MGTF on Si wafer, which is characteristic of amorphous structure. The n (the refractive index) and k (the extinction coefficient) values of CuZrAl MGTF are measured by variable angle spectroscopic ellipsometry in Figure S2. In Fig. S3, we calculate absorption behaviors of absorbers (D = 250 nm, P = 500 nm, H = 60 nm) with different materials of top and bottom layers. The absorber made with CuZrAl MGTF has far superior absorption behavior as compared to Cu, Al, Ag and Nb.

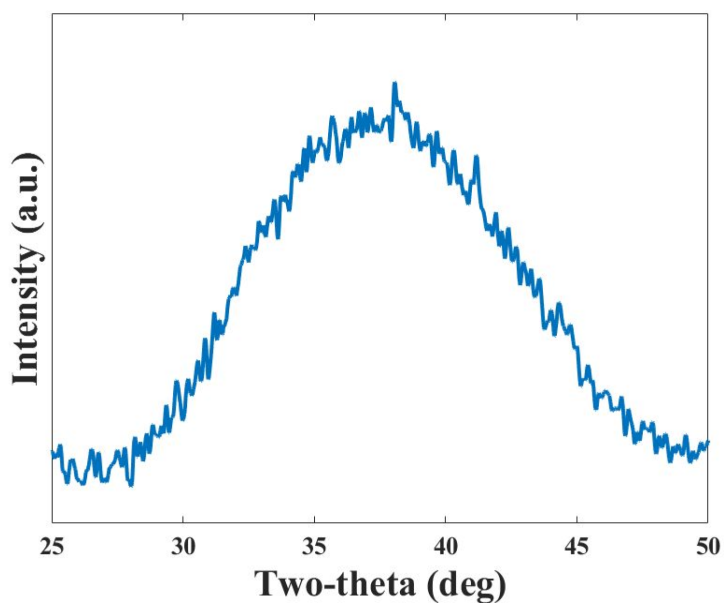

Figure S1. XRD diffraction pattern of the as-deposited 100 nm thick CuZrAl MGTF on Si wafer.

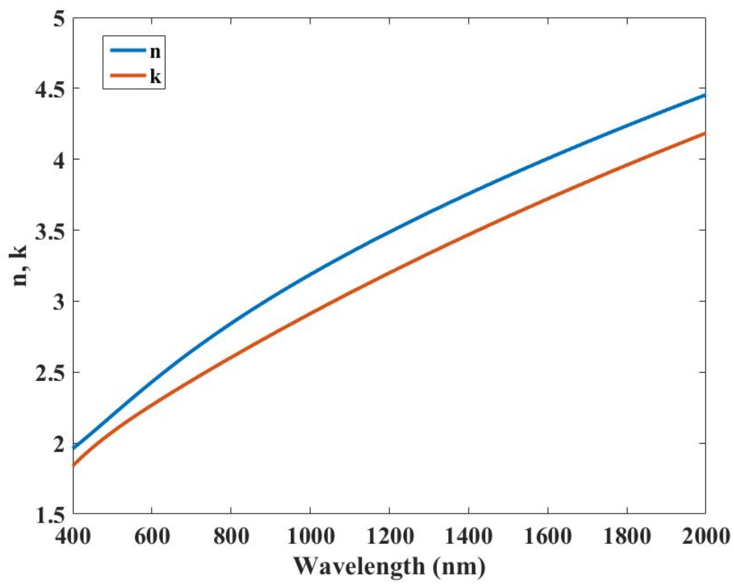

Figure S2. Refractive index and extinction coefficient dispersions of the CuZrAl MGTF measured by variable angles spectroscopic ellipsometry.

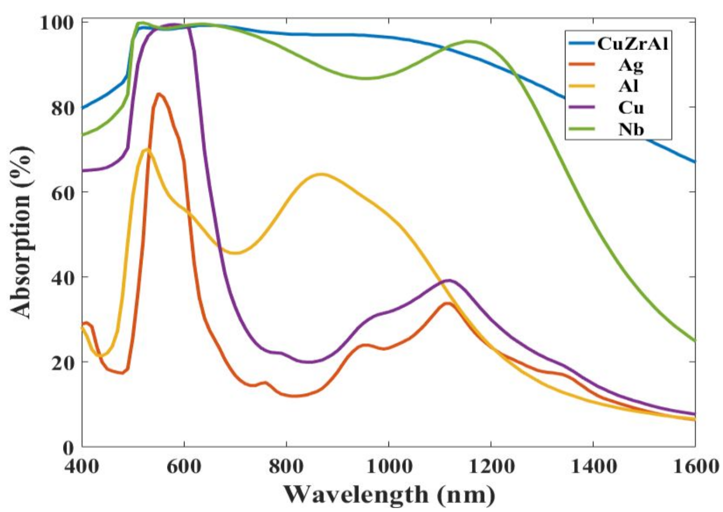

Figure S3. Absorption behaviors of our device made with different materials. Note that we could not find the n and k values for pure Zr material. Thus, we calculated absorption behavior of the neighbor element of Nb instead.

For the preparation of CuZrAl absorber, a 100 nm-thick CuZrAl MGTF was deposited on Si wafer by a direct-current magnetron sputtering system (DCMS, JZCK-400) in a vacuum of 5×10^{-4} Pa chamber under purified argon atmosphere. A 70 nm-thick SiO_2 layer was then deposited on the MGTF by electron beam evaporation (Balzers, BAK600) at room temperature. The CuZrAl nanodisks on SiO_2 layer were fabricated by electron-beam lithography (EBL) systems (CRESTED CABL-9000C).

All numerical simulation results were obtained by Finite-Difference Time-Domain (FDTD) method using Lumerical commercial software package (FDTD solutions). In order to fully absorb scattered light, perfect matched layer (PML) boundary conditions were used in the top and bottom Z planes, while symmetric or anti-symmetric boundary conditions were applied in the X and Y planes to obtain the periodic structure and reduce the computing time. The reflectance R was measured at normal incidence by using a Fourier transform infrared spectrometer (FTIR Vertex 70). For negligible transmission, i.e., the measured transmission was lower than 0.01, absorption A=1-R. The microstructure was monitored by field-emission scanning electron microscopy (FE-SEM, Hitachi S-4800). Optical microscope images of the absorber were measured using a microscope (Nikon 80i).