酸素欠損 WO_x ($2.83 < x < 3$) エピタキシャル薄膜の電子・熱輸送特性

Electron and heat transports of oxygen deficient WO_x ($2.83 < x < 3$) epitaxial films

北大情報[1]，北大電子[2]，東大工[3] ○キムゴウン[1]，ジョヘジュン[1,2]，馮斌[3]，幾原雄一[3]，太田裕道[1,2]

IST[1]- , RIES[2]-Hokkaido U., U. Tokyo, ○G. Kim[1], H.J. Cho[1,2], B. Feng[3], Y. Ikuhara[3], H. Ohta[1,2]

E-mail: woom93@gmail.com

Tungsten oxide (WO_x) has been studied as an active layer of electrochromic devices such as anti-glare mirror and smart window because its color can be controlled electrochemically at room temperature. Although various crystal structures are known in oxygen deficient WO_x, called Magnéli phase such as $WO_{2.9}$, $WO_{2.82}$ and $WO_{2.72}$, the electron and heat transports are not clearly understood yet because of the lack of the study on the epitaxial WO_x. Here we report electron and heat transports of oxygen deficient WO_x ($2.83 < x < 3$) epitaxial films at room temperature. We fabricated WO_x films on (001) $LaAlO_3$ substrate with various x ranging from 2.835 to 2.977 by the pulsed laser deposition technique under controlled oxygen atmosphere. Figures (a) – (c) summarize the electrical conductivity, thermopower, and thermal conductivity of the resultant WO_x epitaxial films. Those of amorphous WO_x films are also plotted for comparison.[1] Both electrical conductivity and thermal conductivity of the epitaxial films dramatically increases when x decreases from 2.98 to 2.95 whereas the absolute value of thermopower decreases from 550 to 30 μV K^{-1}, indicating drastic increase of the carrier concentration. However, these properties do not change a lot when $x < 2.95$, probably due to that structural phase transition occurs around x ~2.95. We believe these systematic electron and heat transport data of oxygen deficient WO_x epitaxial films would be useful to develop WO_x-based devices.

[1] G. Kim *et al.*, *J. Phys. Chem. C*, DOI: https://doi.org/10.1021/acs.jpcc.9b02448 (2019).

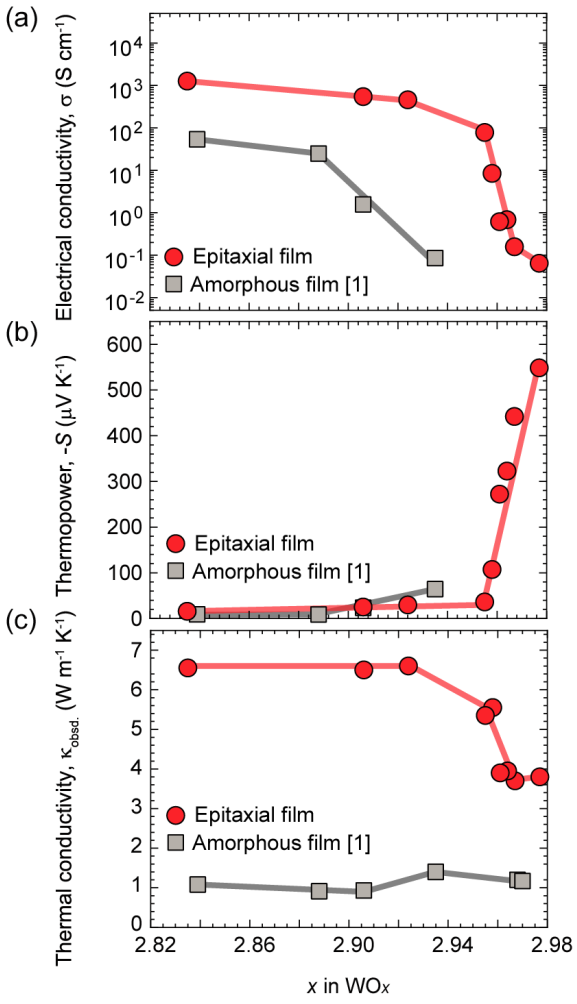

FIG. | Electron and heat transport properties of the WO_x films at room temperature. (a) Electrical conductivity, (b) thermopower, and (c) thermal conductivity.