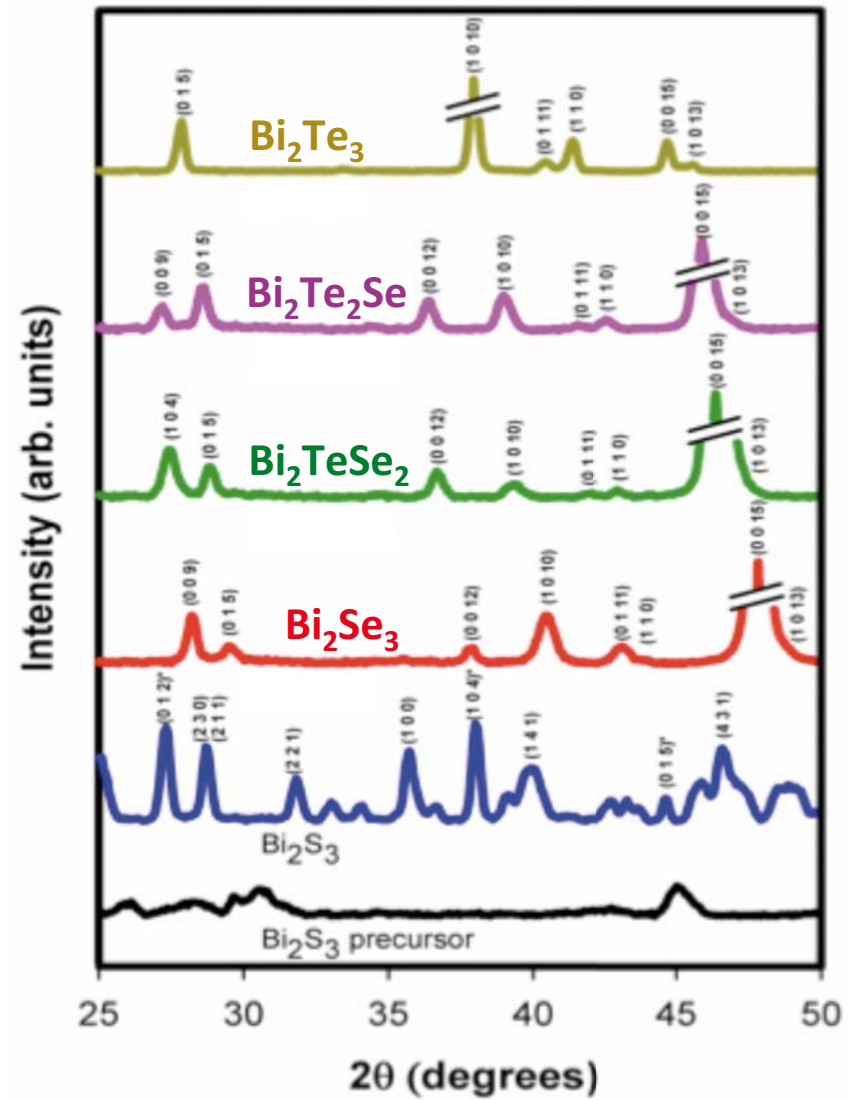
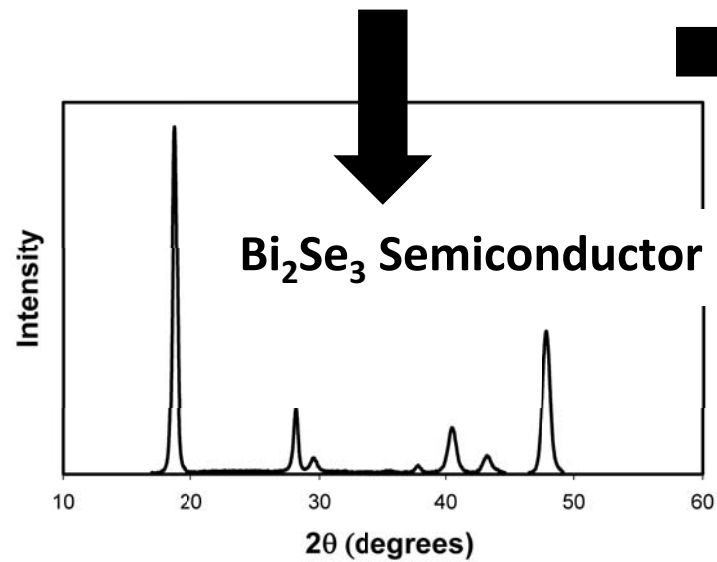
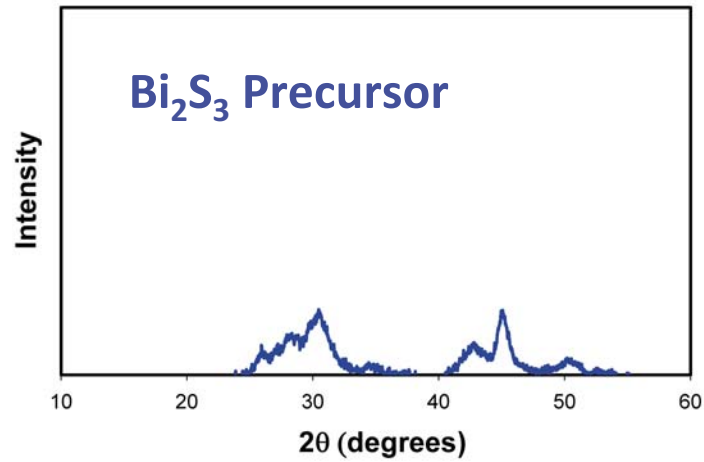


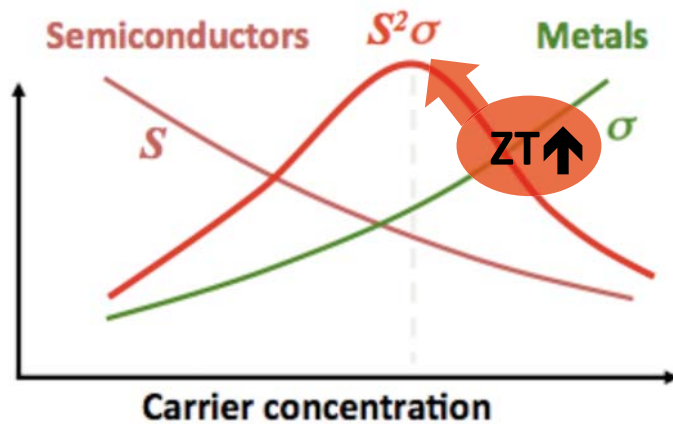
Accessing All Alloys via Liquid Phase



Wang, Feser, Gu, Segalman, Majumdar, Milliron, Urban, (submitted)

Initial Transport Data

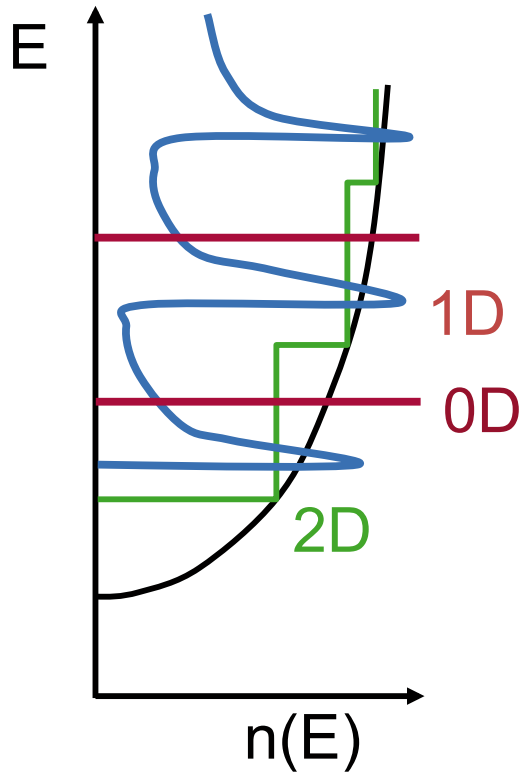
	S ($\mu\text{V/K}$)	σ (S/cm)	$S^2\sigma$ ($\mu\text{W/m-K}^2$)	k (W/m-K)	$ZT_{300\text{K}}$
Bi_2Se_3	-95	475	430	0.6	0.22
Bi_2TeSe_2	-115	325	430	0.3	0.58
$\text{Bi}_2\text{Te}_2\text{Se}$	-185	115	380	0.2	0.64
Bi_2Te_3	-110	25	30	---	---



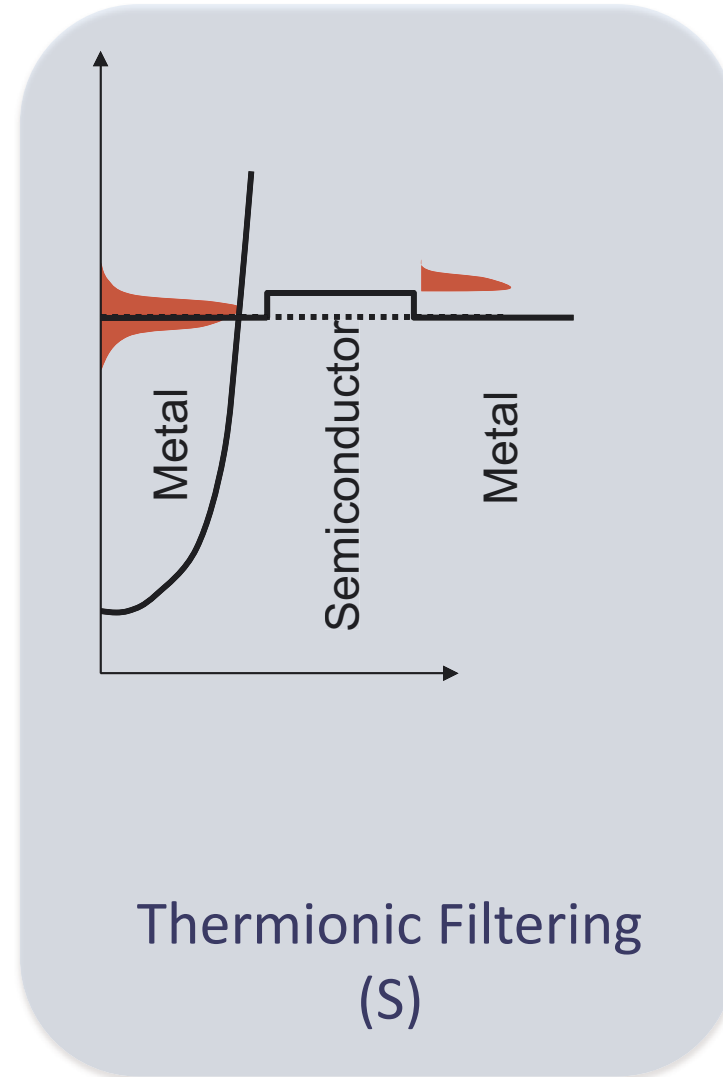
Future Work

1. Optimizing $S^2\sigma$: **Doping Studies**
2. Secondary Phases: **Embedded Structures**

How do we increase $S^2\sigma$?



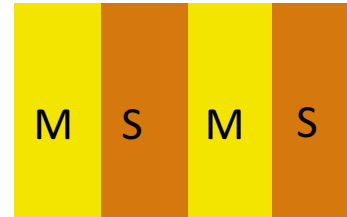
Quantum Structures
(S or k)



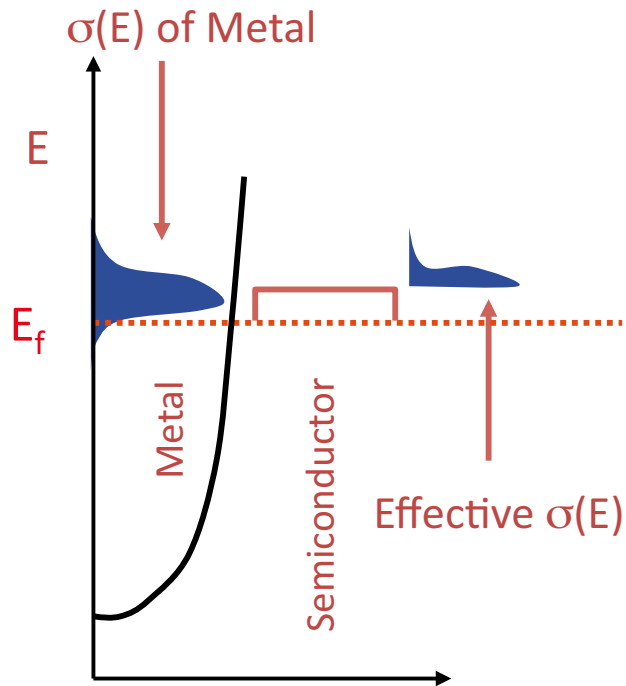
Thermionic Filtering
(S)

Increasing Power Factor: Carrier Filtering Approach

$$ZT = \frac{\uparrow S^2 \sigma T}{k}$$

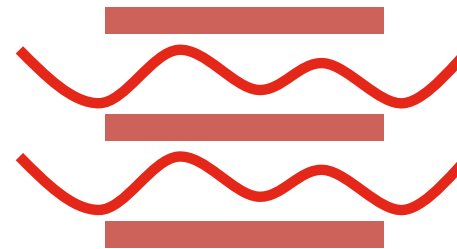


Heterostructures



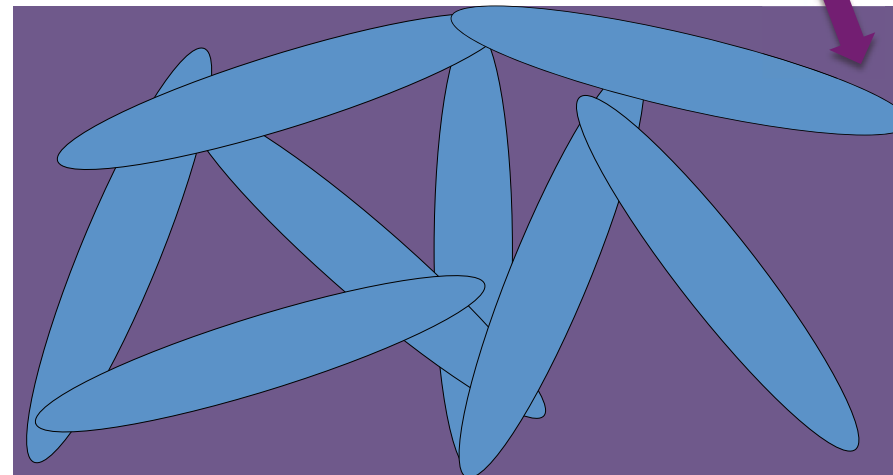
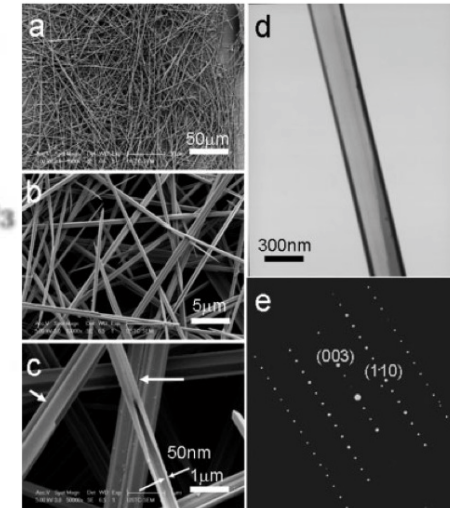
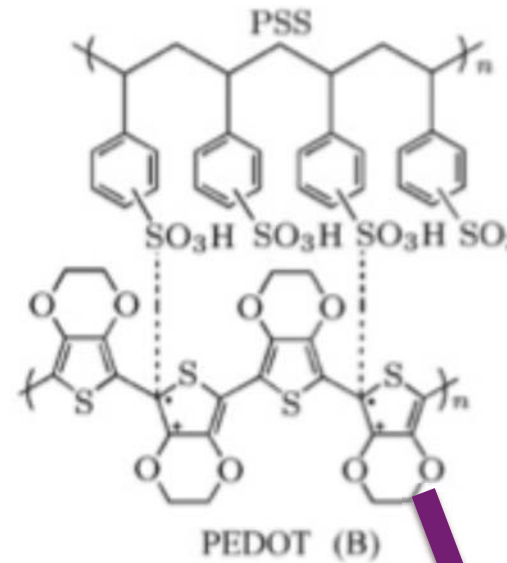
Novel Solution-Based Approach:
Multicomponent Materials

M = layered inorganic host
S = conjugated polymer



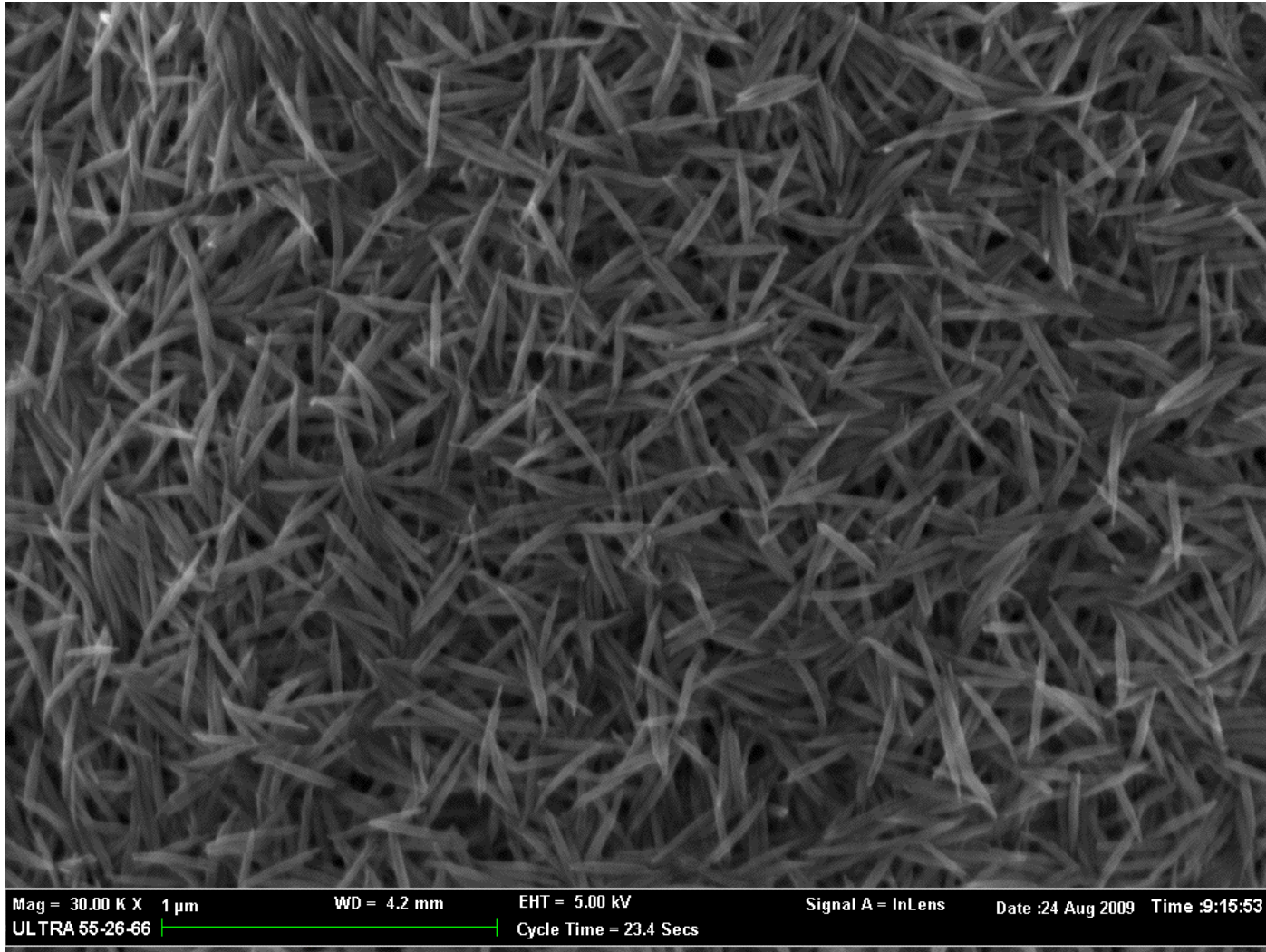
Materials Design for Composite Systems

- *Conjugated Polymer Matrix*
 - Solution processible
 - High σ , Low κ (low S)
- *Inorganic Nanorods*
 - Solution processible
 - High S, Low σ as made (high κ)



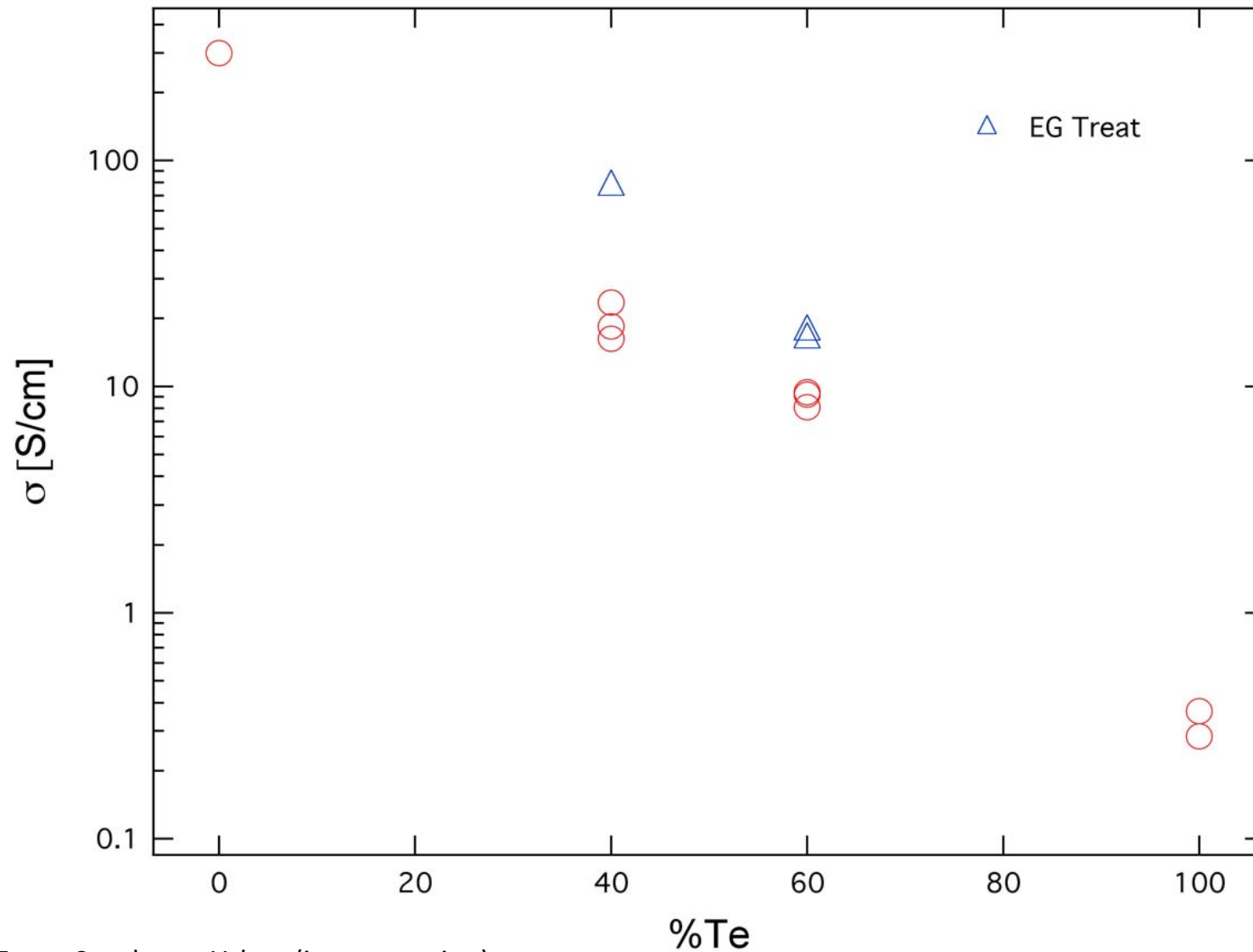
See, Feser, Segalman, Urban (in preparation)

Synthesis and Sample Portrait



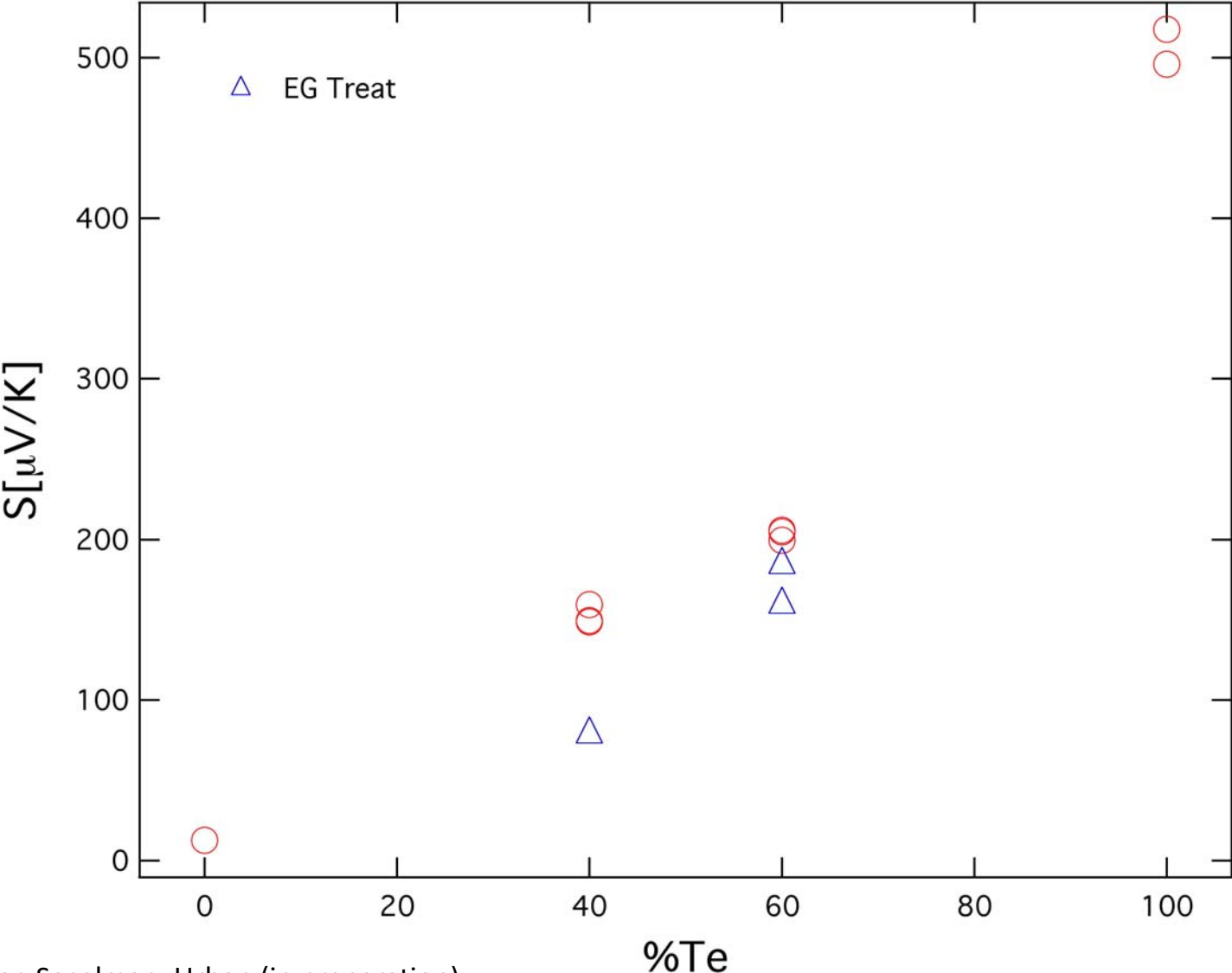
See, Feser, Segalman, Urban (in preparation)

Transport Properties of Composites: Electrical Conductivity



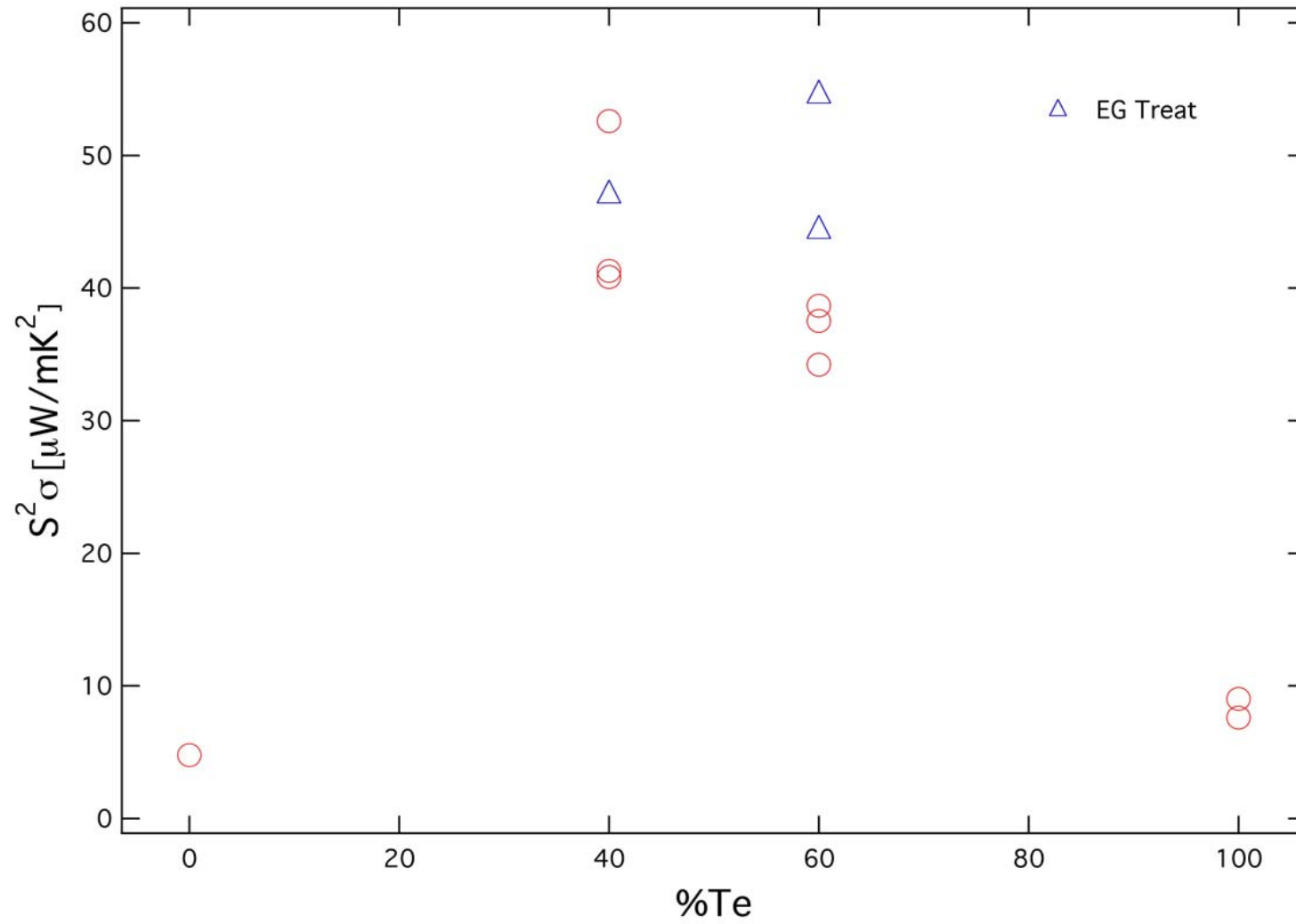
See, Feser, Segalman, Urban (in preparation)

Transport Properties of Composites: Seebeck Coefficient



See, Feser, Segalman, Urban (in preparation)

Power Factor of Composites



See, Feser, Segalman, Urban (in preparation)

Power Factor Comparisons for Solution-Based TEs

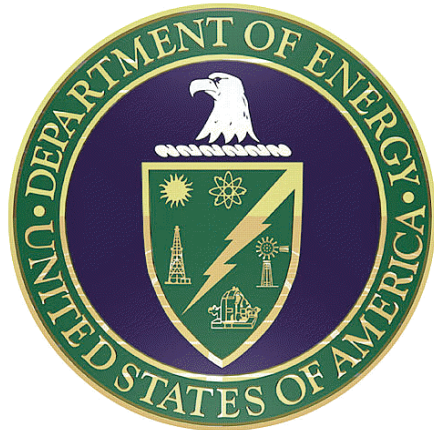
Material System	Max RT PF [$\mu\text{W}/\text{mK}^2$]	Ref
CNT/Epoxy	7.68	<i>Nanolett.</i> 2008 , 8, 4428-4432.
PbTe/PtTe ₂ NPs (spraycoat/sinter)	~35	<i>Adv. Mat.</i> 2009, 21, 3196.
Poly(carbazole)/FeCl ₃	19	<i>Chem. Mat.</i> 2009 , 21, 751-757.
Te nanorods/ Pedot:PSS	54.5	This work
Bi ₂ Te ₃ (polyxtal)	4000	Shakouri et al., 18th int. conf. TEs etc.

See, Feser, Segalman, Urban (in preparation)

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Prof. Rachel Segalman
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Dr. Kevin See

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