Chemistry, Physics, and Materials Science of Thermoelectric Materials: Beyond Bismuth Telluride (Fundamental Materials Research)

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This seriesofbooks, which is publishedattherateofaboutoneper year, addresses fundamental problems in materialsscience.Thecontents coverabroadrangeoftopicsfromsmallclustersofatomstoengineering materials and involve chemistry, physics, materials science, and engineering, withlengthscalesrangingfromAngstromsuptomillimeters. Theemphasis is on basic scienceratherthan on applications. Each book focuses on a single areaofcurrent interest and brings together leading experts to give an up-to-date discussion oftheir work and the workof others. Each articlecontainsenough references thattheinterestedreader can access the relevant literature. Thanks are given to the Center for Fundamental Materials Research at Michigan State University for supportingthisseries. M.F.Thorpe, SeriesEditor E-mail: thorpe@pa.msu.edu EastLansing, Michigan, November2002 v PREFACE ThisvolumerecordsinvitedlecturesgivenattheNewThermoelectric(TE)Materials Workshopheld inTraverseCity, MichiganfromAugust17-21,2002.Thethemeofthe workshop was Chemistry, PhysicsandMaterials ScienceofThermoelectric Materials: Beyond Bismuth Telluride. The objective of this symposium was threefold. First, to examine and assess the ability of solid state chemistry to produce new generation materials for TE applications. Second, to rationalize and predict the charge and heat transportpropertiesofpotentialcandidatesandhypotheticalsystemsthroughsolidstate theoryandexperiment.Third, toidentifyandprioritizeresearchneededtoreachvarious levelsofrequirementsintermsofZTandtemperature.Theseobjectiveswereaddressed by a series of invited talks and discussions by leading experts from academia, governmentlaboratories, andindustry. Thereweretwenty-twoinvitedandeightposterpresentations inthe workshop.Out ofthese, sixteeninvitedpresentationsarerepresentedinthisvolume.Theycoverawide range of subjects, starting from synthesis (based on different strategies) and characterizationofnovel materials to acareful studyoftheir transport properties and electronicstructure.Topicsaddressingtheissueofmakingnew materialsare: synthetic search for new materials (di Salvo et aI.) and synthetic strategies based on phase homologies (Kanatzidis). The different classes of materials covered are: bismuth nanowires (Dresselhausetal.), unconventional high-temperaturethermoelectrics, boron carbides (Aselage et aI.), layered cobalt oxides (Fujii et aI.), early transition metal antimonides(KleinkeetaI.), skutterudites(Uher), andclathratethermoelectrics(Nolas).

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