Hot Articles

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Science & Technology

Title: Single crystal growth by the traveling solvent technique: A review

Author: S.M. Koohpayeh

Journal: Progress in Crystal Growth and Characterization of Materials

Volume: 62 **Issue:** 4 **Page:** 22–34

Doi: 10.1016/j.pcrysgrow.2016.03.001

Abstract

A description is given of the traveling solvent technique, which has been used for the crystal growth of both congruently and incongruently melting materials of many classes of intermetallic, chalcogenide, semiconductor and oxide materials. The use of a solvent, growth at lower temperatures and the zoning process, that are inherent ingredients of the method, can help to grow large, high structural quality, high purity crystals. In order to optimize this process, careful control of the various growth variables is imperative; however, this can be difficult to achieve due to the large number of independent experimental parameters that can be grouped under the broad headings 'growth conditions', 'characteristics of the material being grown', and 'experimental configuration, setup and design'. This review attempts to describe the principles behind the traveling solvent technique and the various experimental variables. Guidelines are detailed to provide the information necessary to allow closer control of the crystal growth process through a systematic approach. Comparison is made between the traveling solvent technique and other crystal growth methods, in particular the more conventional stationary flux method. The use of optical heating is described in detail and successful traveling solvent growth by optical heating is reported for the first time for crystals of Tl_5Te_3, Cd_3As_2, and $FeSc_2S_4$ (using Te, Cd and FeS fluxes, respectively).

Database

ScienceDirect

Title: Atomic layer deposition of high-k dielectrics on III–V semiconductor surfaces

Author: Theodosia Gougousi

Journal: Progress in Crystal Growth and Characterization of Materials

Volume: 62 **Issue:** 4 **Page:** 1-21

Doi: 10.1016/j.pcrysgrow.2016.11.001

Abstract

The goal of this article is to provide an overview of the state of knowledge regarding the Atomic Layer Deposition (ALD) of metal oxides on III–V semiconductor surfaces. An introduction to ALD, the band structure, various defects present on the III–V surface and how they relate to Fermi level pinning are discussed. Surface passivation approaches are examined in detail in conjunction with experimental and computational results. The “interface clean-up” reaction that leads to the formation of a sharp gate oxide/semiconductor interface is related to the surface chemistry and the transport of the surface oxides through the growing dielectric film. Finally, the deposition of metal oxides on semiconductors is discussed in the context of interface quality and some examples of devices using III–V channels and ALD metal oxides are given.

Database

ScienceDirect

Title: Thermal conductivity of sandwich panels made with synthetic and vegetable fiber vacuum-infused honeycomb cores

Author: Juan P Vitale, Gaston Francucci, Ariel Stocchi

Journal: Journal of Sandwich Structures & Materials

Volume: 19 **Issue:** 1 **Page:** 66 - 82

Doi: 10.1177/1099636216635630

Abstract

Building, naval, and automotive industries have deep interest in eco-friendly, lightweight, stiff and strong materials. In addition, materials with low thermal conductivity are desirable in many applications where energy savings and thermal comfort are needed. In response to these requirements, sandwich panels were manufactured using glass and jute fiber composite skins bonded to different cores: balsa wood, Divinycell® and honeycombs. These honeycombs, as well as the skins, were manufactured by the vacuum infusion technique using polyester resin and jute, glass and carbon fiber fabrics. In this work, the thermal properties and density of the sandwich panels were measured and compared.

Database

SAGE Journals Online

Title: Sound transmission loss characteristics of sandwich aircraft panels: Influence of nature of core

Author: MP Arunkumar, Jeyaraj Pitchaimani, KV Gangadharan, MC Lenin Babu

Journal: Journal of Sandwich Structures & Materials

Volume: 19 **Issue:** 1 **Page:** 26 - 48

Doi: 10.1177/1099636216652580

Abstract

Sandwich panel which has a design involving acoustic comfort is always denser and larger in size than the design involving mechanical strength. The respective short come can be solved by exploring the impact of core geometry on sound transmission characteristics of sandwich panels. In this aspect, the present work focuses on the study of influence of core geometry on sound transmission characteristics of sandwich panels which are commonly used as aircraft structures. Numerical investigation has been carried out based on a 2D model with equivalent elastic properties. The present study has found that, for a honeycomb core sandwich panel in due consideration to space constraint, better sound transmission characteristics can be achieved with lower core height. It is observed that, for a honeycomb core sandwich panel, one can select cell size as the parameter to reduce the weight with out affecting the sound transmission loss. Triangular core sandwich panel can be used for low frequency application due to its increased transmission loss. In foam core sandwich panel, it is noticed that the effect of face sheet material on sound transmission loss is significant and this can be controlled by varying the density of foam.

Database

SAGE Journals Online

Title: Analytical study on the mechanical performance of composite sandwich shells for dielectric radar domes

Author: Veysel Alankaya

Journal: Journal of Sandwich Structures & Materials

Volume: 19 **Issue:** 1 **Page:** 108 - 130

Doi: 10.1177/1099636215613296

Abstract

Radar domes are the cover structures over the radar antenna systems to provide environmental protection to the sensitive parts such as electronics, steering hardware, wave guide, additional equipments, and antenna itself. Composite dielectric materials are preferred solutions for radome construction because of their negligible effects on electromagnetic transmission of enclosed antenna. Very recently, the effect of interlaminar stress distribution and radome geometry over the transmission capabilities is reported by several researchers. The aim of this study is to present an efficient solution methodology with minimized mathematical effort for the analytical solution of sandwich composite dielectric materials for radome structures with one and double core layers. Analytical solution methodology for the analyses of stresses and deformations is based on Third-Order Shear Deformation Theory (TSDT). Double Fourier series which are specialized for boundary discontinuity are used to solve highly coupled linear partial differential equations. Numerical solutions for the designed spherical radome geometry with one and double core layers are presented for laminated sandwich shells to provide benchmark results for the pre-design activities of radome structures.

Database

SAGE Journals Online

Title: Size Effect On Heat Transfer In Nanoscale Liquid Bridge

Author: Minsub Han

Journal: Nanoscale and Microscale Thermophysical Engineering

Volume: 20 **Issue:** 3-4 **Page:** 158-172

Doi: 10.1080/15567265.2016.1248804

Abstract

Heat transfer in a nanoscale liquid–argon bridge between planar gold surfaces is investigated using molecular dynamics simulation and continuum analysis. Heat transfer in the nanoscale bridge turns out to be significantly less efficient than in the bulk. The departure from the macroscopic thermal property depends on two sizes: bridge length and width. As the width gets smaller, the heat transfer in the bridge deteriorates due to the meniscuses that narrow the heat path and constrict the transfer. On the other hand, the heat transfer deteriorates with decreasing bridge length due primarily to inhomogeneous density distribution. An elevated and oscillatory density in the solid–liquid interfacial region and a reduced density in the middle region are developed in the bridge. The layering structure increases the acoustic scattering and the lowered density reduces the number of energy carriers. Overall effects of the two contributions vary with bridge length, which causes the size effect in the heat transfer of nanoscale liquid bridges.

Database

Taylor & Francis Journals

Title: High Power Density Pyroelectric Energy Conversion in Nanometer-Thick $BaTiO_3$ Films

Author: Bikram Bhatia, Hanna Cho, J. Karthik, Jangho Choi, David G. Cahill, Lane W. Martin & William P. King

Journal: Nanoscale and Microscale Thermophysical Engineering

Volume: 20 **Issue:** 3-4 **Page:** 137-146

Doi: 10.1080/15567265.2016.1252820

Abstract

Solid-state pyroelectric nanomaterials can be used for thermal-to-electrical energy conversion in the presence of temperature fluctuations. This article reports investigation of energy conversion in a 200 nm thick $BaTiO_3$ film using the pyroelectric Ericsson cycle at cycle frequencies up to 3 kHz. The high cycle frequencies were achieved due to the low thermal mass of the nanometer-scale film, unlike previous studies in which the electrical power output was limited by the rate of heat transfer through the pyroelectric material. A microfabricated platform that allowed precise thermal and electrical cycling enabled us to study the effect of electric field range, temperature oscillation amplitude, and cycle frequency on the electrical power output from pyroelectric Ericsson cycles. We measured a maximum power density of 30 W/cm^3 for a temperature range 20–120°C and electric field range 100–125 kV/cm, which represents a significant improvement over past work on pyroelectric cycles. The approach presented in this article could lead to high-power waste heat harvesting in systems with high-frequency temperature oscillations.

Database

Taylor & Francis Journals

Title: Subcooled Flow Boiling Over Microstructured Plates In Rectangular Minichannels

Author: Yağmur Şişman, Abdolali Khalili Sadaghiani, Khedir R. Khedir, Matthew Brozak, Tansel Karabacak & Ali Koşar

Journal: Nanoscale and Microscale Thermophysical Engineering

Volume: 20 **Issue:** 3-4 **Page:** 173-190

Doi: 10.1080/15567265.2016.1248584

Abstract

Microstructures offer enhancements in boiling heat transfer by increasing bubble departure frequency, active nucleation site density, critical cavity size, and surface area. Integration of microstructures to surfaces alters significant surface parameters such as porosity of the microstructured plates, contact angle, and configuration of microstructures on the surface, which all affect boiling heat transfer. The goal of this study is to investigate boiling heat transfer on different microstructured plates and the effect of various microscale surface morphologies on boiling heat transfer. The microstructured surfaces were formed on aluminum alloy 2024 sheets with the use of a simple and environmentally friendly technique of random mechanical sanding (grits of #36, #60, #400, and #1,000). Distilled water was pumped using a micro gear pump to the rectangular minichannel test section at flow rates of 100, 180, and 290 ml/min, which correspond to mass fluxes of 5.46, 10.58, and 16.15 kg/m^2.s, respectively. It was observed that surfaces with low grit (grit #36) showed no considerable enhancement, whereas the use of higher grit counts considerably enhanced boiling heat transfer up to a critical grit count. The results were supported by the images from the performed visualization of flow boiling.

Database

Taylor & Francis Journals

Title: Background of SAM atom-fraction profiles

Author: Frank Ernst

Journal: Materials Characterization

Volume: 125 **Issue:** - **Page:** 142–151

Doi: 10.1016/j.matchar.2017.01.034

Abstract

Atom-fraction profiles acquired by SAM (scanning Auger microprobe) have important applications, e.g. in the context of alloy surface engineering by infusion of carbon or nitrogen through the alloy surface. However, such profiles often exhibit an artifact in form of a background with a level that anti-correlates with the local atom fraction. This article presents a theory explaining this phenomenon as a consequence of the way in which random noise in the spectrum propagates into the discretized differentiated spectrum that is used for quantification. The resulting model of “energy channel statistics” leads to a useful semi-quantitative background reduction procedure, which is validated by applying it to simulated data. Subsequently, the procedure is applied to an example of experimental SAM data. The analysis leads to conclusions regarding optimum experimental acquisition conditions. The proposed method of background reduction is based on general principles and should be useful for a broad variety of applications.

Database

ScienceDirect

Title: Effect of small addition of Cr on stability of retained austenite in high carbon steel

Author: Rumana Hossain, Farshid Pahlevani, Veena Sahajwalla

Journal: Materials Characterization

Volume: 125 **Issue:** - **Page:** 114–122

Doi: 10.1016/j.matchar.2017.02.001

Abstract

High carbon steels with dual phase structures of martensite and austenite have considerable potential for industrial application in high abrasion environments due to their hardness, strength and relatively low cost. To design cost effective high carbon steels with superior properties, it is crucial to identify the effect of Chromium (Cr) on the stability of retained austenite (RA) and to fully understand its effect on solid-state phase transition. This study addresses this important knowledge gap. Using standard compression tests on bulk material, quantitative X-ray diffraction analysis, nano-indentation on individual austenitic grains, transmission electron microscopy and electron backscatter diffraction–based orientation microscopy techniques, the authors investigated the effect of Cr on the microstructure, transformation behaviour and mechanical stability of retained austenite in high carbon steel, with varying Cr contents. The results revealed that increasing the Cr %, altered the morphology of the RA and increased its stability, consequently, increasing the critical pressure for martensitic transformation. This study has critically addressed the elastoplastic behaviour of retained austenite – and provides a deep understanding of the effect of small additions of Cr on the metastable austenite of high carbon steel from the macro- to nano-level. Consequently, it paves the way for new applications for high carbon low alloy steels.

Database

ScienceDirect