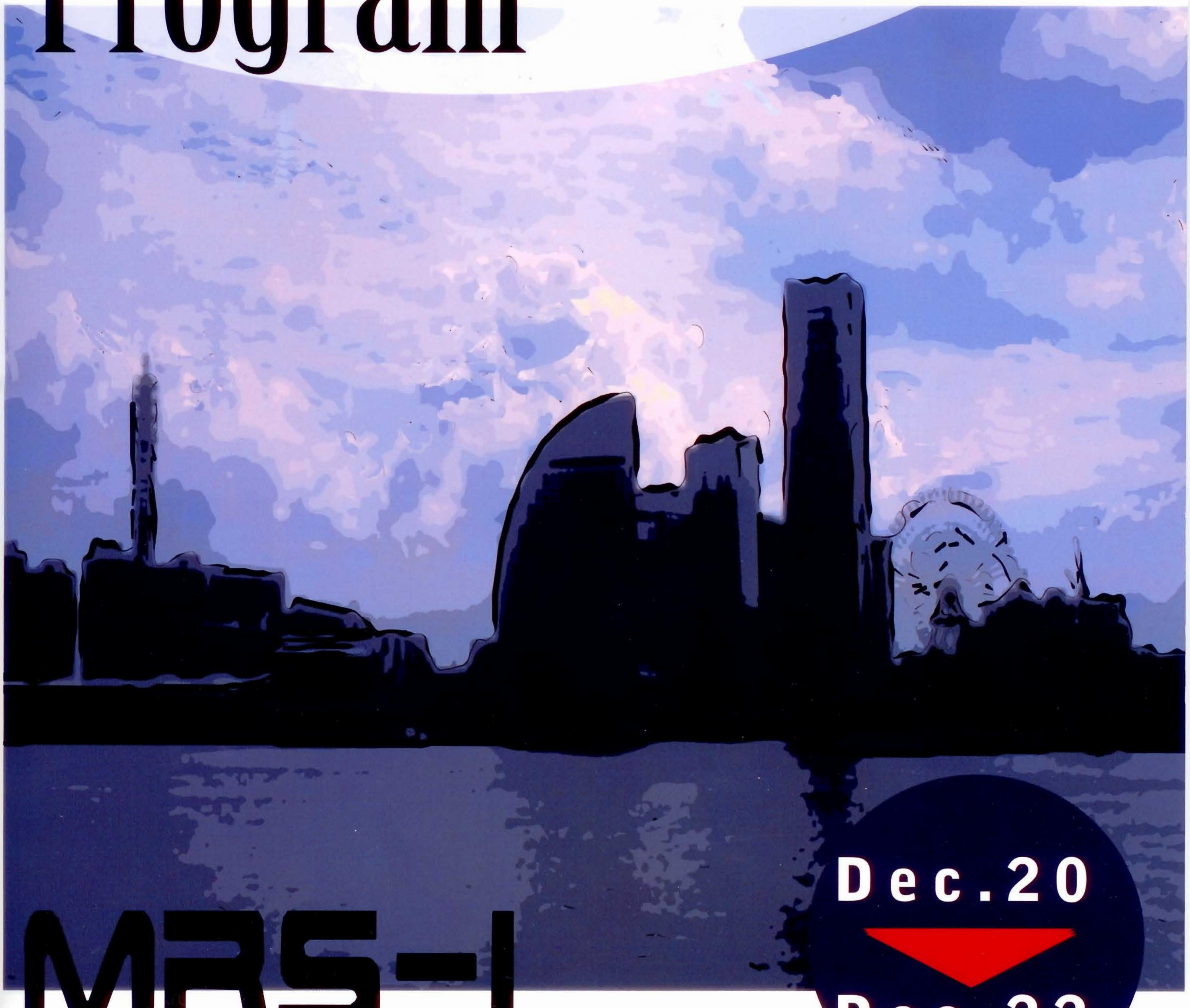
Advanced Materials Research Breakthroughs to Ecoinnovation II

20th Academic Symposium of MRS-Japan 2010

Program



Dec.20

Dec.22

MRS-J

The Materials Research Society of Japan

▼ 14:45 ～ 16:15 午後の部 | Afternoon oral session
Part S7 座長：馬場 恒明 | Chair: Koumei Baba

S-18-I Invited
14:45-15:15 「Ion beam modified Silicon for Nanomechanics」
○G. Rius (Toyota Technologial Institute, IMB-CNM), J. Llobet(IMB), X. Borrisé, F. Perez-Murano(IMB-CNM Spain)

S-19 -I Invited
15:15-15:45 「Industrial and Biomedical Applications of Plasma Technology」
○Ricky K. Y. Fu (Plasma Technology Limited Hong Kong), Paul K. Chu (City Univ. of Hong Kong Hong Kong)

S-020
15:45-16:00 「プラズマCVDとイオン注入を用いたインチサイズの単結晶ダイヤモンドウェハの作製 Plasma CVD and Ion Beam Implantation for Fabrications of Inch-Size Wafers of Single-Crystal-Diamond」
○山田 英明，茶谷原 昭義，坪内 信輝，杢野 由明（AIST） | ○Hideaki Yamada , Akiyoshi Chayahara , Nobuteru Tsubouchi, Yoshiaki Mokuno(AIST)

S-021-M
16:00-16:15 「シロキサンに対する集束プロトンビームによる微細加工 | Micro-patterning of thick Siloxane films by Proton Beam Writing」 ○土屋 龍太郎，西川 宏之（芝浦工大） | ○Ryutaro Tsuchiya, Hiroyuki Nishikawa (Shibaura Institute of Technology)

16:15-16:20 **Closing Remark**

December 21st, 11:40-12:40 : Committee and Invited Speaker Meeting

S-19 ,I Invited

Industrial and Biomedical Applications of Plasma Technology

Ricky K. Y. Fu [1] and Paul K. Chu [2]*
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Plasma can be effectively generated by various methods in vacuum, atmosphere, and liquid. Metallic filtered vacuum arc discharge FCVA, gas glow discharge, plasma spraying, and plasma electrolytic oxidation (PEO) are promising techniques in materials fabrication and surface modification. By properly manipulating the plasma and energetic ions and with the aid of related techniques, this methodology is extremely useful and widely practiced in industrial and biomedical applications. In this invited presentation, important plasma techniques will be presented and their use to produce thin films, thick coatings and ion implanted layers to alter the functionalities of various types of substrates, devices, and components in industrial and biomedical applications is described. Recent research work conducted in the Plasma Laboratory of City University of Hong Kong pertaining to the materials fabrication and the surface modification for industrial components and biomedical engineering will also be described. Applications examples include carbon films embedded with nanocrystals with good thermal stability, formation of micro-porous and thick oxide films on light metallic alloys for enhanced wear and corrosion resistance, plasma spraying and hydrogen plasma implantation to produce relatively thick bioactive ceramic coatings on orthopedic implants that favor the growth of bone-like apatite, and novel plasma-treated smart spinal correction rods that can automatically correct severe scoliosis inside the patients.

S-20

Plasma CVD and ion beam implantation for fabrications of inch-size wafers of single-crystal-diamond

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Single-crystal-diamond (SCD), which has characteristics superior to those of other semiconductor materials, is expeeted to be one of the promising materials to realize high-performance electronic devices in the future. However, difficulty to obtain inch-size wafers of SCD obstructs its diverse application. For example, at present, commercially available size of SCD is several millimeters. This is mainly due to difficulties of 1) erystal-growth, 2) processing, i.e. cutting and polishing, to realize free-standing wafers, and 3) to enlarge a seed erystal. Mierowave plasma chemical vapor deposition (MWCVD) is widely utilized to grow SCD in stable manner. The discharge is generated by injection of microwave power into electrons followed by ehemical reaction among eleetron and source gas hydrocarbon speeies. These eoupling of high frequency electromagnetic field with electrons and eomplex reaetion paths of hydrocarbon species make it difficult to understand and control the growth by using MWCVD. Further, it is not easy to apply probe measurements on such discharge under high-gas pressure, e.g. 0.2 atm., which is usually adopted for SCD growth. This motivates us to start numerical simulation of MWPCVD. We found that under such situation the governing equations could be reduced much simpler than those general forms [1]. By using this model, distributions of electron, power density, gas-temperature and radical species have been studied. Such information is very useful to understand the growth mechanism and predict improved reaetor design. On the other hand, we sueceeded in fabricating free-standing wafer by using ion-beam-implantation [2]. After the implantation, SCD layer grew on the injected surfaee. Then, the graphitic layer, which was generated by the implantation, was selectively etched. This procedure was successfully applied to obtain several free-standing wafers from an identical wafer. We found and verified that these "clone wafers" which was made from one identical wafer could be fused into one larger wafer. We fused half-inch size wafers into one inch size wafer. Again, the ion-beam-implantation technique was applied to this one inch size mosaic wafer, and we succeeded in fabricating several one inch size mosaie wafers [3].

References: [1] Yamada, et al., J. Appl. Phys. 101(2007), 063302 [2] Mokuno, et al., Diamond Relat. Mater. 18 (2009) 1258 [3] Yamada, et al., App. Phys. Exp. 3, (2010) 051301