

# 2<sup>nd</sup> International School

## “Laser-surface interactions For new materials production: Tailoring structure and properties”

**School Directors:**

**C. Boulmer-Leborgne**

**M. Dinescu**

**J. T. Dickinson**

**P. M. Ossi**

**Isola di San Servolo**

**Venezia**

**July 11-18, 2010**

<http://veniceschool2010.inflpr.ro>



**VIU**  
Venice  
International  
University



The school is endorsed by:



The school is sponsored by:



**Where** : S. Servolo Island (Venice, Italy)

**When** : July 11 - 18, 2010

**Highlights** : laser - surface interaction mechanisms  
controlled material modification  
surface nanostructures  
ultra-short pulses  
electronic excitation - relaxation  
non-linear absorption phenomena  
surface melting, vaporisation, superheating  
metastable systems  
target, plume, deposited film diagnostics  
defects  
plasmonics  
nanocatalysts

**Addressed at** : doctorate students, young post-docs

**School Directors** : C. Boulmer-Leborgne  
M. Dinescu  
J. T. Dickinson  
P.M. Ossi

**Website** : <http://ppam.inflpr.ro>



PROVINCIA DI VENEZIA  
ISOLA DI SAN SERVOLO

PROVINCIA DI VENEZIA ISOLA DI SAN SERVOLO

isola di  
san servolo

BENVENUTI  
WELCOME







### Temperature Requirements

- Pulpal temperature should not be increased by more than 1°C at the pulp
- Temperature increases with laser power and repetition rate and varies with laser type, e.g., outline dry procedure less heat for given parameters
- A CO<sub>2</sub> laser coated with an air-water spray produced smaller pulpal temperature changes to those caused by an air-water coated speed drill

ENICE INTERNATIONAL









Novosibirsk State University, Pirogova St. 2, 630090 Novosibirsk, Russia  
 The Institute of Computational Technologies, Siberian Branch of RAS, Novosibirsk, Russia  
 The Institute of Thermophysics, Siberian Branch of RAS, Novosibirsk, Russia

### Modeling of laser vaporization of compound semiconductors taking into account components interdiffusion

O.A. Bulgakova, V.P. Zhukov, N.M. Bulgakova

**Motivation**  
 Models of laser vaporization dynamics of multicomponent semiconductors aimed to predict laser evaporation under conditions of laser processing of surface synthesis of nanoparticles, and ion free-laseration. Calcium hydroxide is chosen as a model material.

**Applications of laser ablation**

**Mathematical problem**  
 Heat flow equation:  

$$\rho \frac{dT}{dt} = \nabla \cdot (\kappa \nabla T) + Q$$

$$\rho = \rho_0 (1 - \beta(T - T_0))$$

$$\kappa = \kappa_0 (1 - \beta(T - T_0))$$

$$Q = Q_0 \exp(-\alpha z)$$
 Initial and boundary conditions:  

$$T|_{z=0} = T_0$$

$$T|_{z=L} = T_0$$

$$T|_{t=0} = T_0$$

**Mathematical problem**  
 Diffusion equation:  

$$\frac{\partial C_i}{\partial t} = D \nabla^2 C_i$$
 Boundary condition:  

$$D \frac{\partial C_i}{\partial z} = J_i$$
 At the initial moment:  

$$C_i(x, 0) = C_{i0}(x, 0)$$

**Results: Temperature evolution, melting**

**Results: 2. Particle fluxes from the surface**

**Conclusion and prospects**



