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## Structural Insights into the RNA Degradation Mechanism

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RNA degradation is determinant in the control of gene expression. The maturation, turnover and quality control of RNA is performed by many different classes of ribonucleases. One class of these enzymes degrade single-stranded RNA from its 3' end and release ribonucleoside 5'-monophosphates [1]. Exoribonucleases can act independently or as a component of the exosome, an essential RNA-degrading multiprotein complex [2]. X-ray crystallographic structures of both the ligand-free (at 2.4 Å resolution) and RNA-bound (at 2.8 Å resolution) forms of an exoribonuclease were solved using ESRF synchrotron data by MIRAS using selenomethionine and Hg acetate derivatives. The structure is organized into 4 domains, three cold shock and one catalytic domain that shows an unprecedented αβ-fold. The enzyme establishes contacts with RNA in two distinct regions, the 'anchor' and the 'catalytic' regions, which act synergistically to provide catalysis. The active site is buried within the catalytic domain, in a pocket formed by four conserved sequence motifs. The structure shows that the catalytic pocket is only accessible to single stranded RNA, and explains the specificity for RNA *versus* DNA cleavage. It also explains the dynamic mechanism of RNA degradation by providing the structural basis for RNA translocation and enzyme processivity [3].

[1] Mitchell, P., Petfalski, E., Shevchenko, A., Mann, M. & Tollervey, D. The exosome: a conserved eukaryotic RNA processing complex containing multiple 3'-->5' exoribonucleases. *Cell* 91, 457-66 (1997).

[2] van Hoof, A., Frischmeyer, P. A., Dietz, H. C. & Parker, R. Exosome-mediated recognition and degradation of mRNAs lacking a termination codon. *Science* 295, 2262-4 (2002).

[3] Lejeune, F., Li, X. & Maquat, L. E. Nonsense-mediated mRNA decay in mammalian cells involves decapping, deadenylating, and exonucleolytic activities. *Mol Cell* 12, 675-87 (2003); LaCava, J. et al. RNA degradation by the exosome is promoted by a nuclear polyadenylation complex. *Cell* 121, 713-24 (2005).

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## Measurement and modelling of residual stresses and texture in aluminium interconnects in micro-electronic devices

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This work is presented here as an example of an investigation in which it turned out to be possible to estimate residual stress distributions on a sub-micrometer scale by concurrently using X-ray diffraction, scanning electron microscopy combined with Orientation Imaging Microscopy (OIM), and micromechanical modeling. An elastic-plastic crystalline constitutive model implemented in a finite element code [1] has been used to predict the thermal residual stresses in Al-1%Si-0.5%Cu interconnects. This fully 3D model accounts for the individual grain orientations in these interconnects, as measured by Orientation Imaging Microscopy (OIM). The influence of specific crystal orientations on the residual stress distribution in these interconnects was studied in detail [2]. A sensitivity analysis was performed to identify the parameters that influence strongly the predicted values of the residual stresses and their distributions. For the interconnects studied here, the residual stresses in the metal lines were found to be quite sensitive to the elastic modulus of the passivation material and its geometry. Further, the volume averages of the predicted stresses were in reasonable agreement with the experimentally determined values from the X-ray technique.

[1] S.R. Kalidindi, C.A. Bronkhorst, L. Anand, *J. Mech. Phys. Solids* 40 (1992) 537.

[2] A. Saerens, P. Van Houtte and S.R. Kalidindi, *Journal of Materials Research* 16 (2001) 1112-1122.