



Introduction

Nanoleakage was originally used to describe microporous zones beneath or within hybrid layers that allowed tracer penetration to occur in the absence.¹ More recently, aqueous solution of 50 wt% ammoniacal silver nitrate (pH = 9.5) has been used to revealed the porosity and subsequent permeability of the hybrid layer, even in the absence of marginal gaps.² This type of leakage results from penetration paths through the network of interfibrillar spaces with a few nanometers range size and so, the term “nanoleakage” was introduced.

Objectives

To analyze the resin-dentin interdiffusion-zone (hybrid layer) and the nanoleakage, promoted by an universal adhesive system, with transmission electron microscopy (TEM).

Results

TEM analysis revealed a 0.5µm thick resin-dentin interdiffusion-zone for the Scotchbond Universal adhesive system, in self-etch mode (Figures 1-4) .

Hydroxyapatite crystallites were observed in the hybridized layer (Figures 1,2,4,5).

As previous described to the MDP-containing adhesives, nano-layering could be found with high magnification, particularly near the top of the resin-dentin interdiffusion-zone.³ (Figures 3,6)

The pattern of the nanoleakage detected was spot and reticular type. However, no relevant nanoleakage was observed. (Figures 2,3)

Materials and Methods

Ten dentin disks were obtained from ten human caries-free molars;

Scotchbond Universal adhesive system (3M-ESPE) was used as self-etch mode;

Disks were restored with Grandio SO Flow resin (Voco);

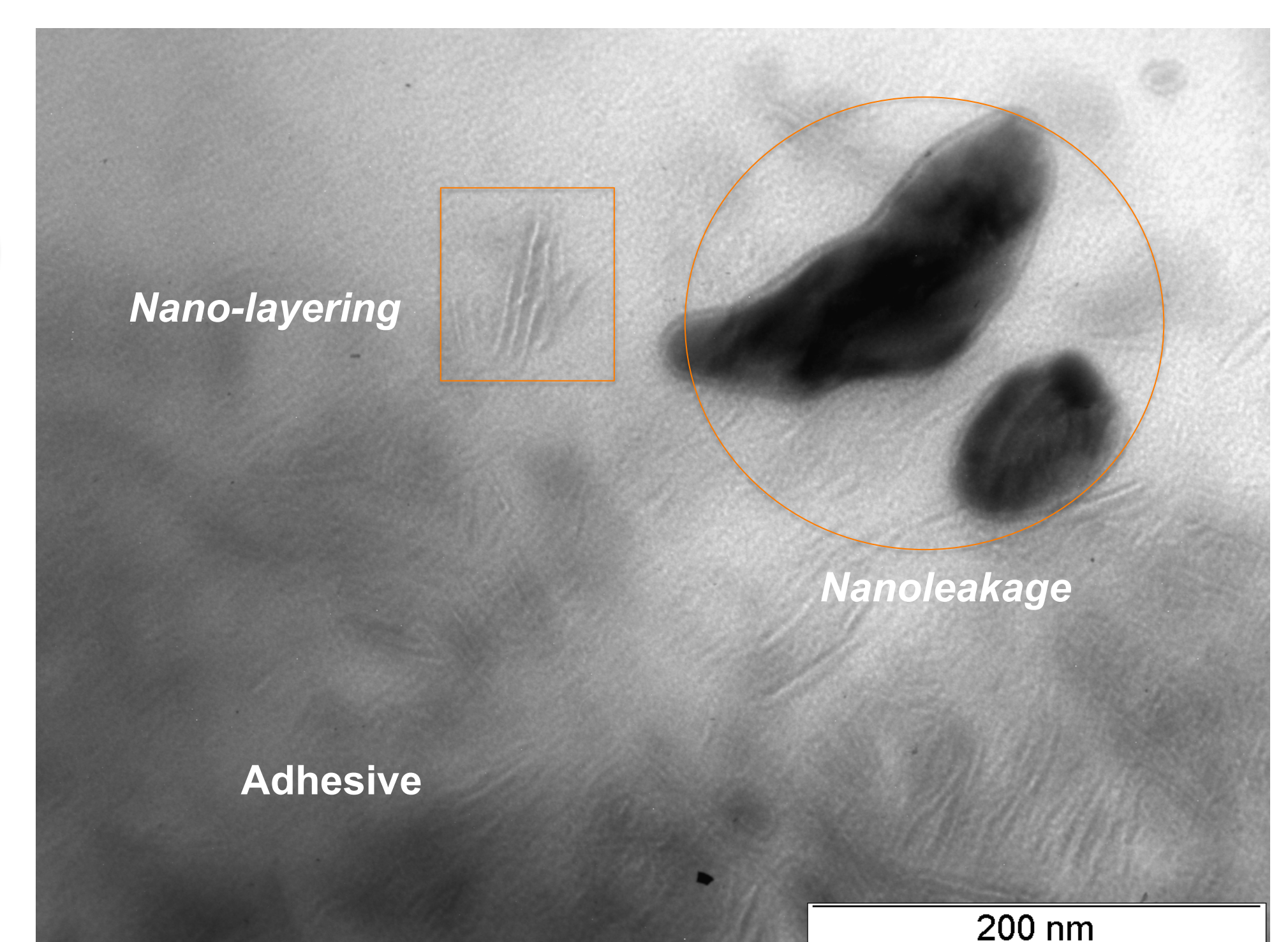
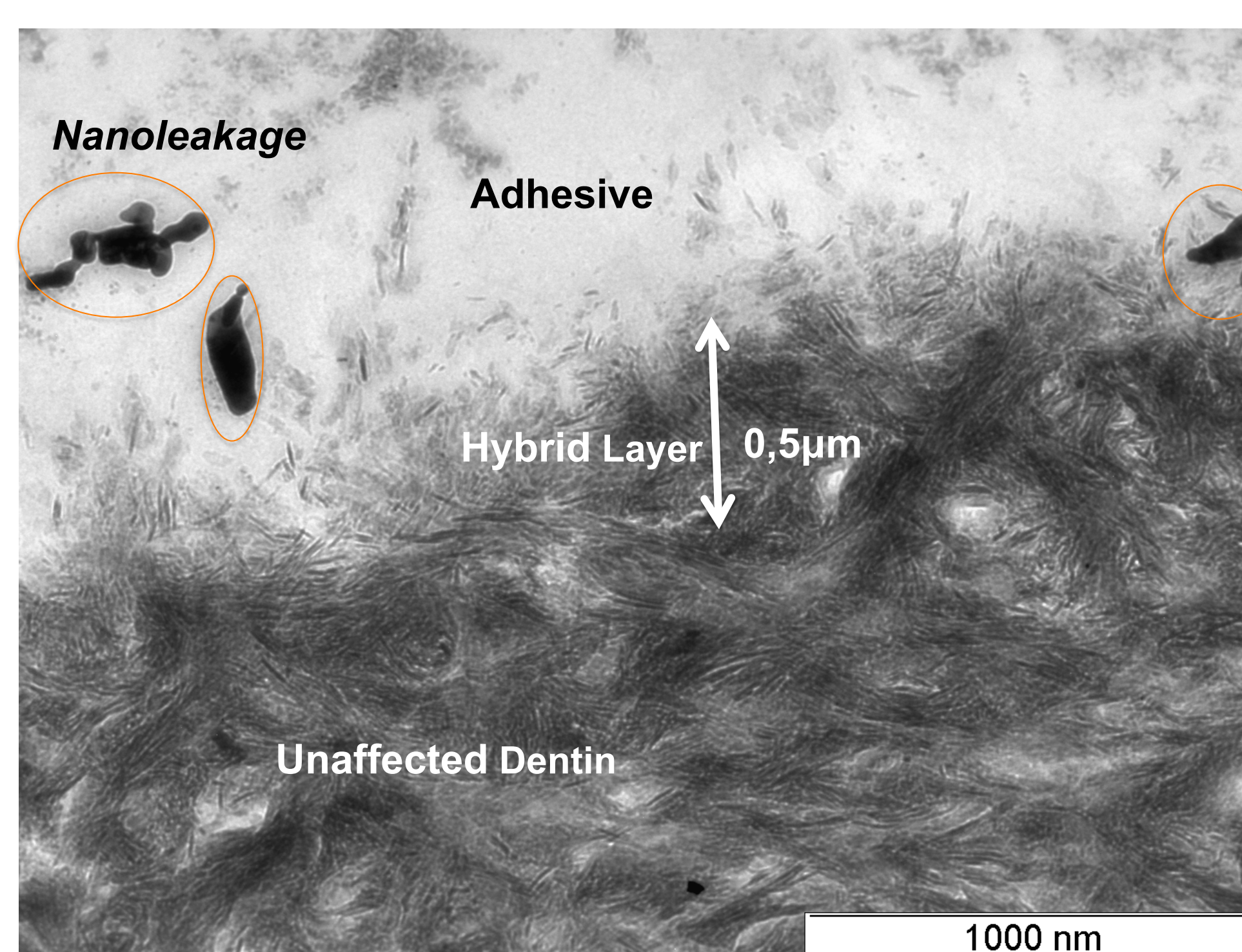
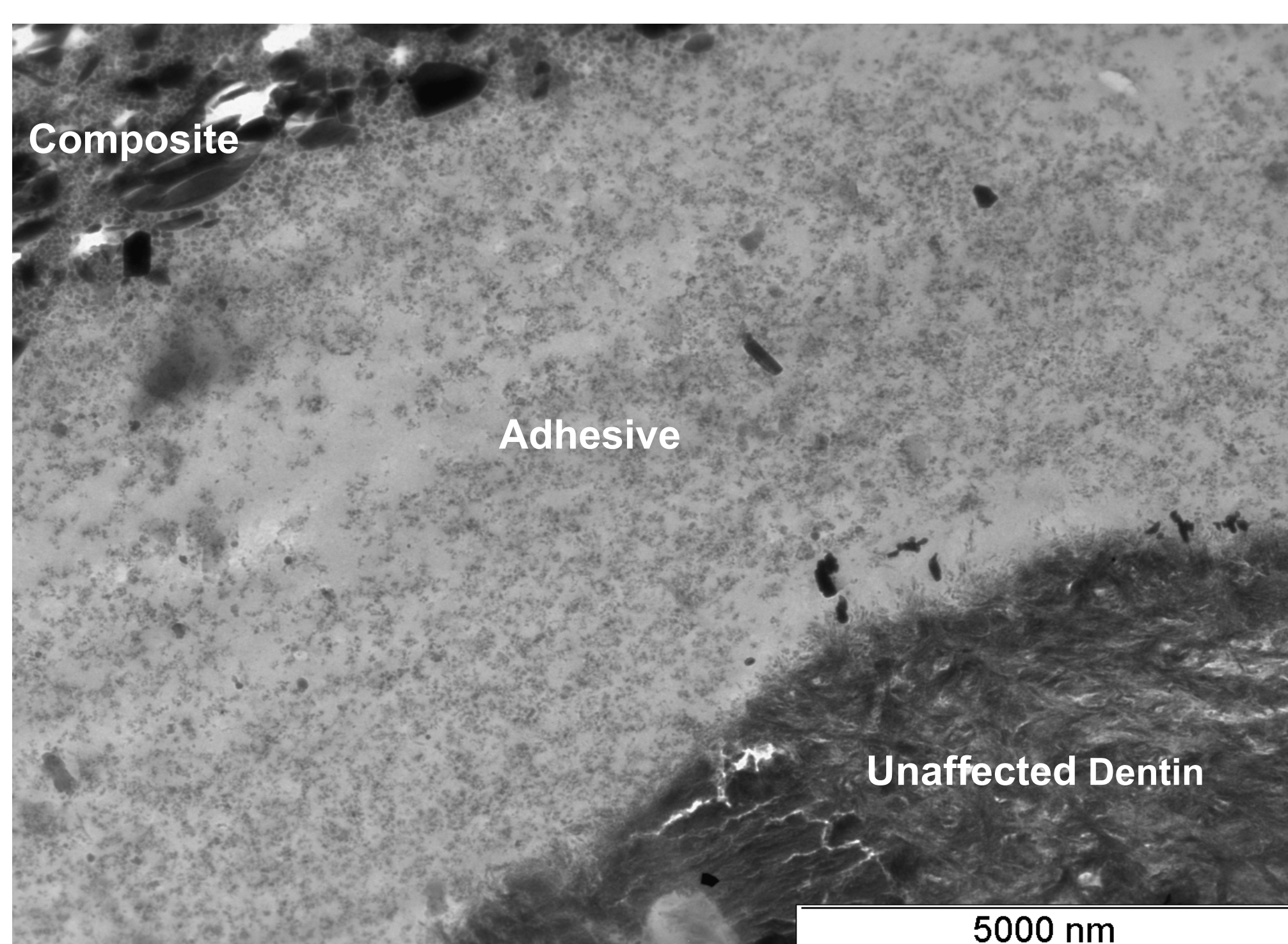
All the materials were used according to manufacturers’ instructions;

Specimens were sectioned with a precision saw [IsoMet 1000 precision saw(Buehler)] in order to obtain sticks with a cross section of 0.8±0.2 mm²;

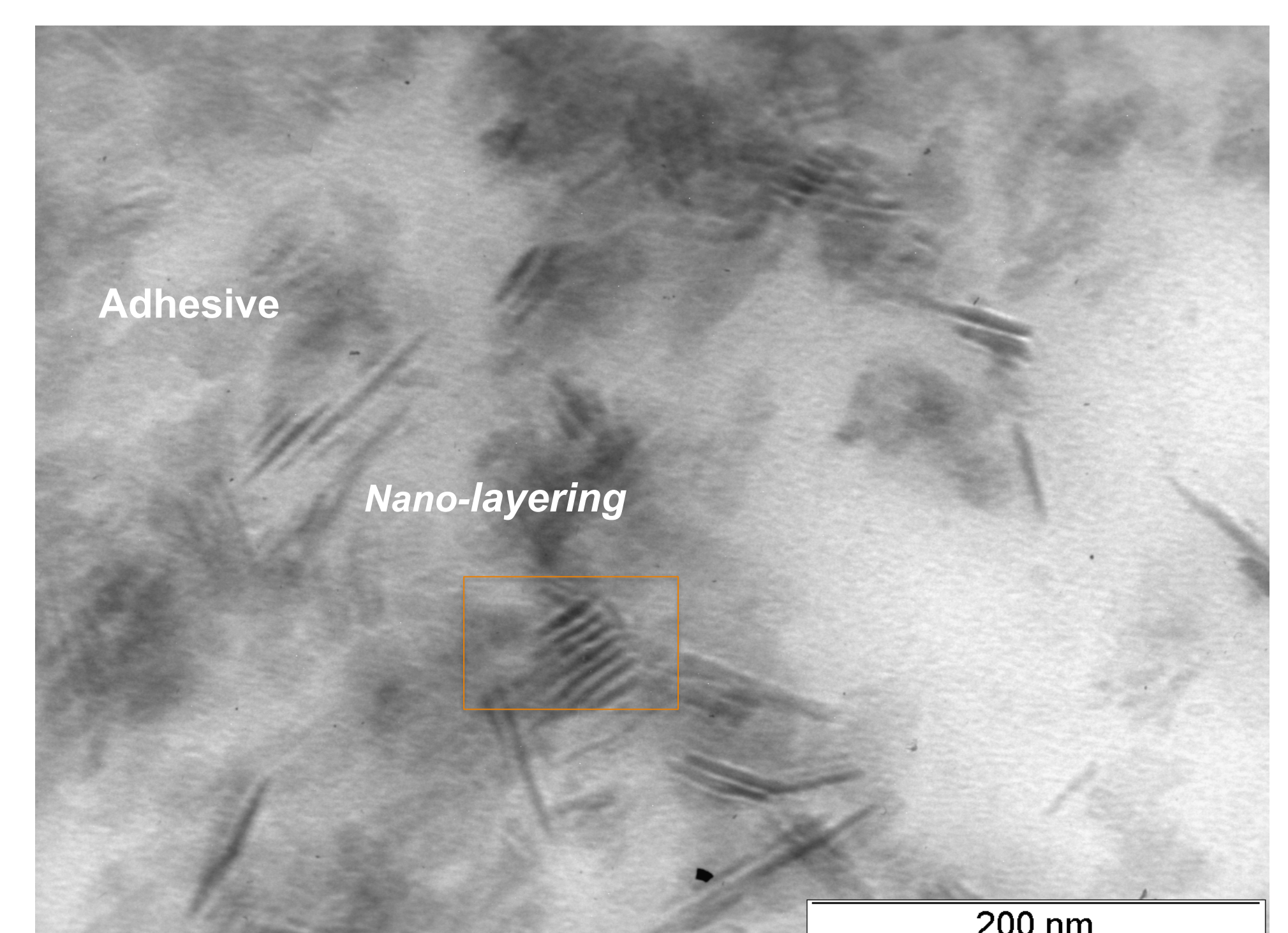
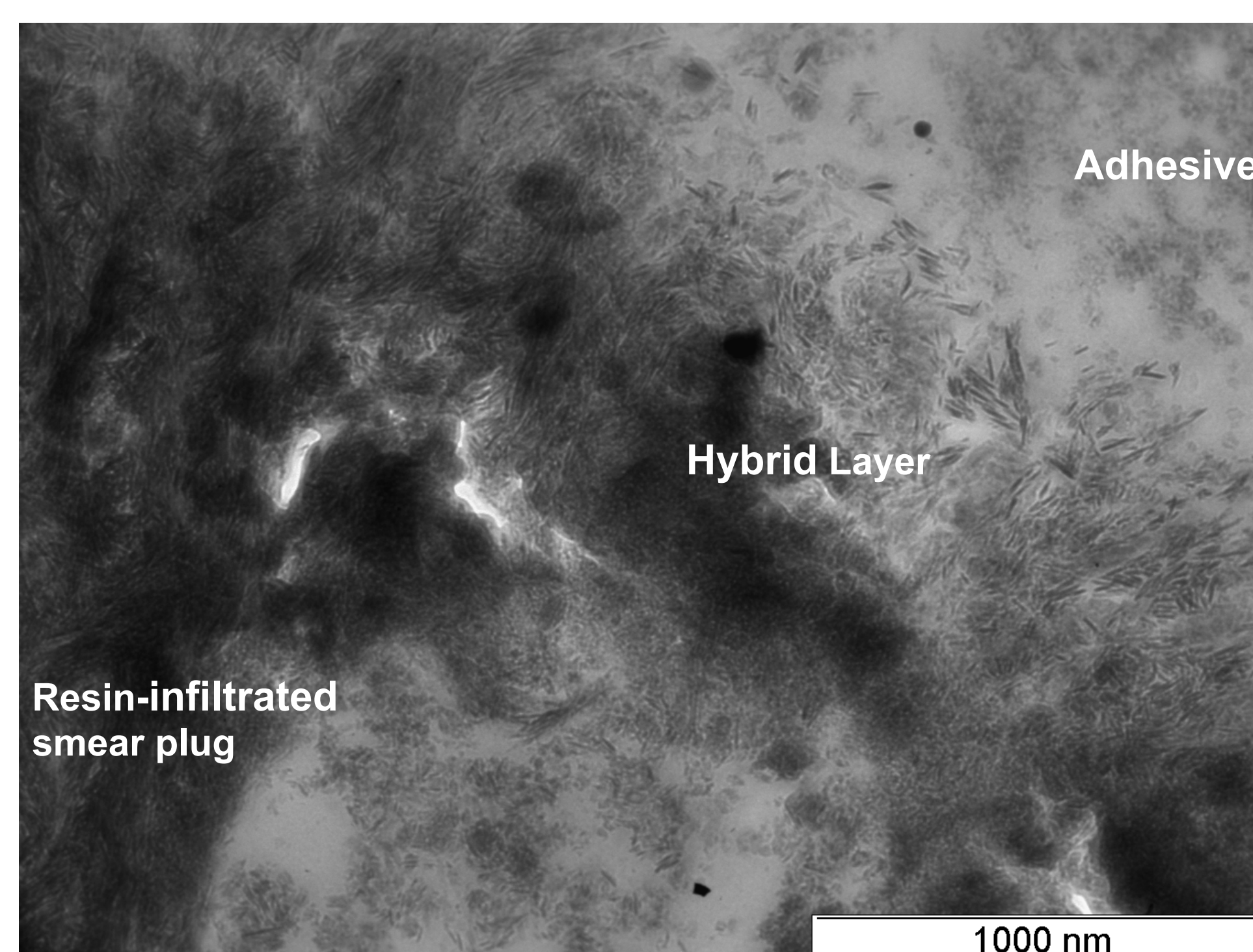
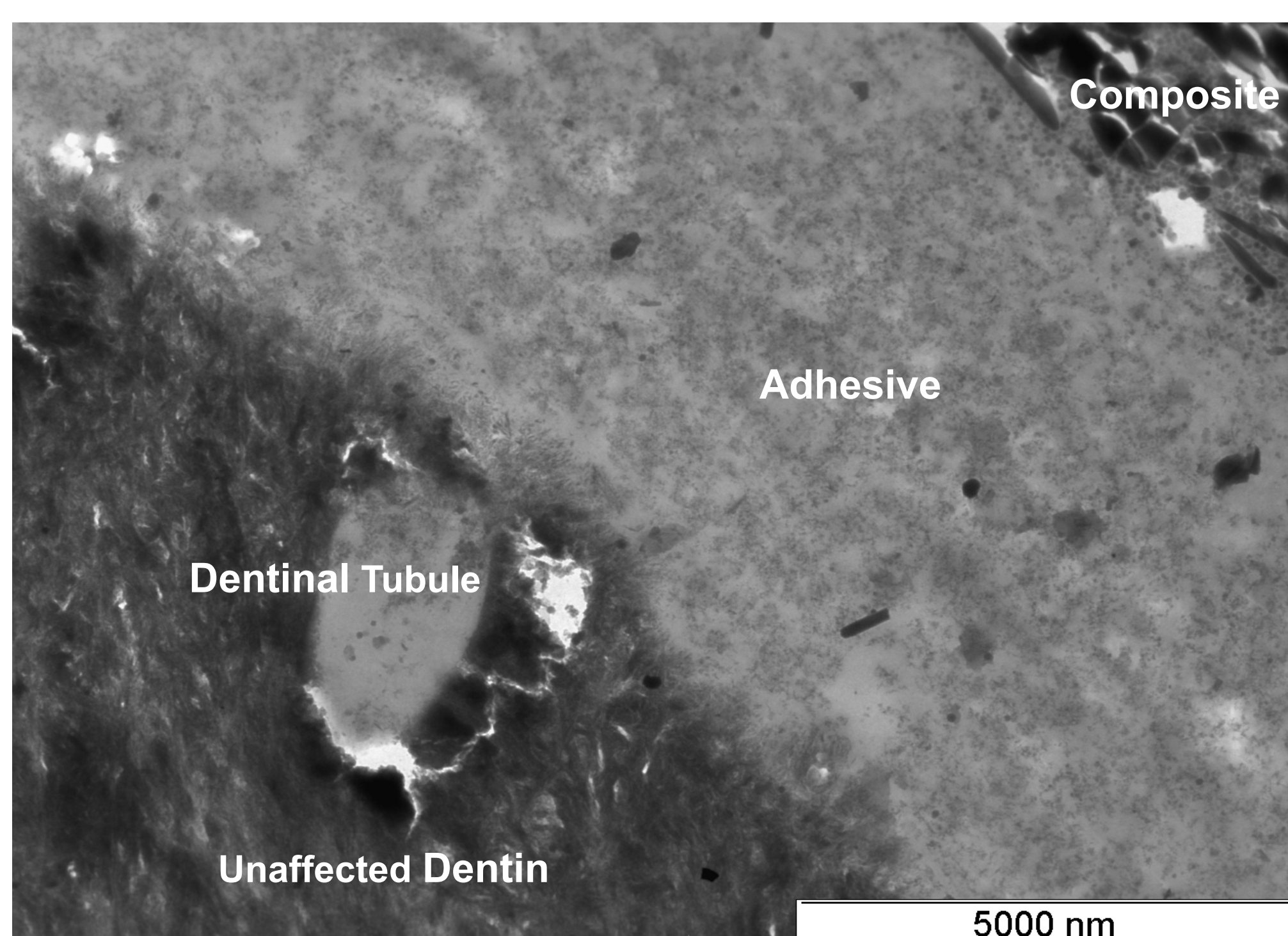
Sticks were coated with two layers of fast setting nail varnish, applied 1mm from the bonded interfaces, then immersed in ammoniacal silver nitrate (50%wt; pH=9.5) for 24h and then placed in photo-developing solution for 8h under a fluorescent light;

Specimens were sectioned with an ultra-microtome (LKB Ultratome III) and processed to TEM analysis;

Silver penetration at resin-dentin interdiffusion-zone was examined with TEM (Hitachi H-8100), with an accelerating voltage of 100KV.



Figures 1,2,3 – TEM micrograph of Scotchbond Universal adhesive, as self-etch mode (location 1). Magnification 2000x, 10000x, 50000x, respectively.



Figures 4,5,6 – TEM micrograph of Scotchbond Universal adhesive, as self-etch mode (location 2). Magnification 2000x, 10000x, 50000x, respectively.

Conclusions

Scotchbond Universal adhesive, in self-etch mode, revealed a homogeneous resin-dentin interdiffusion-zone, with no relevant nanoleakage, at 24h.

Higher magnifications confirmed nano-layering at the adhesive interface, extending into the adhesive layer.

References

1- Sano H, Takatsu T, Ciucchi B, Horner JA, Matthews WG, Pashley DH. Nanoleakage: leakage within the hybrid layer. Oper Dent 1995;20(1): 18-25. 2- Tay FR, Pashley DH. Dental adhesives of the future. J Adhes Dent 2002;4:91-103. 3- Yoshida Y, Yoshihara K, Nagaoka N, Hayakama S, Torii Y, Ogawa T, Osaka A, Van Meerbeek B. Self-assembled nano-layering at the adhesive interface. J Dent Res 2012; 91 (4):376-381.

Acknowledgments: Authors wish to thank 3M-ESPE and VOCO for the material used in this study. Authors declare that there are no conflicts of interest.