RDT&E IWG Paint and Other Coatings Questions

1. What is the literature on the transfer and retention of paints and coatings evidence?

   Individual, successive, and cross-transfer simulations, totaling 198 such scenarios, were carried out between crowbars and painted wood substrates in order to study the phenomenon of transfer as well as evaluate the amount of paint transferred. Chemical composition and age of the paint influenced the amount of observed transfer with bidirectional cross-transfer between the wood and tool regularly observed. Secondary paint transfers from the substrate were also regularly observed.


   A frequency of occurrence study of paint chips observed on the outer clothing and footwear of 213 high school students from different areas of the Vancouver, British Columbia, Canada was conducted, in which paint was found on approximately 14% of the outer clothing items, and on approximately 24% of footwear. The authors noted that the percentages were significantly lower than figures reported in similar studies in the previous 25 years.


   A questionnaire regarding the evidential value of paint transfer in 8 traffic accident cases was distributed to 235 paint examiners working in crime laboratories. 124 replies were received with conclusions ranging from “slight support” to “conclusive” allowed.


   Over the course of three months, 100 pairs of men’s jackets and trousers were chosen at random from a dry cleaning business and examined for the presence of glass and paint transfer. When fragments of identical color and layer structure were grouped together, 1077 paint samples were counted.

   http://projects.nfstc.org/trace/2009/presentations/7-marsh-highway.pdf
This study posed several questions:

How common is the presence of random automotive paint chips on a person’s clothing?

100 garments were shaken with surface debris collected and examined at ~25X magnification. When all paint chips were counted, 95/100 garments contained paint for a total number of 1,253 paint chips divided into 1,008 different populations. Of these, 9% contained 2 layers and 1% contained 3+ layers; none of the recovered paint chips were automotive.

How common are random automotive paint chips on the road?

Results indicated paint chips ranging in size from 100-2200 microns were found in 20/27 (74%) of samples, for a total of 191 paint chips in 113 different populations. Further, 41 paint chips contained more than 2 paint layers (21%); only 3 were automotive paint chips, which were observed in two samples. Therefore, the ‘chance’ of finding car paint chips in this sample population was 2/27 (e.g., 7%).

If car paint chips are found on the victim’s clothing, how significant is this finding?

From a high chance (+74%) that paint chips are present on the road, only 7% were car paint chips.

Therefore, the finding of car paint chips on a person’s clothing at random is very unlikely since it was rare to find random automotive paint chips from the road transferred to clothing in this investigation (0/ 1,253 paint chips were car paint)

2. What literature describes the quantitative and qualitative optical, morphologic/structural, physical or chemical properties and features, useful for layered component and whole sample paints and coatings examinations?

The list is extensive; examples of some of the more relevant articles follow.


3. *What is the literature on the classification of paints and coatings and their component pigments, binders, and vehicles?*

The list is extensive; examples of some of the more relevant articles follow.


4. What is the literature on the variation of paints and coatings?

The list is extensive; examples of some of the more relevant articles follow.


5. What is the literature on the persistence of paints and coatings evidence, including the effects of weathering (e.g. sunlight, humidity, temperature, etc.), aging (e.g. oxidation, etc.), post washing and waxing effects, and how it affects the conclusions of paints and coatings analysis?

The list is extensive; examples of some of the more relevant articles follow.


The book explains paint processing and potential causes for defects in laymen's terms.


Describes in laymen’s terms OEM finishes, layer systems, and do-it-yourself (DIY) concepts for refinishing.


6. What published databases of paints, pigments, and manufacturers are available for paints and coatings analysis and comparison?


Reference Collection of Automotive Paints (1991), Collaborative Testing Services, McLean, VA.


Trade journals periodic updates on trends, formulations, and specific changes to binders, pigments, and manufacturing processes as they affect layer systems and colors. Examples: *Automotive News, Coatings World, Paint and Coatings Industry*.


7. What published instrumental spectral databases are available for paints and coatings analysis and comparison?


Sadlter libraries for FTIR spectra of paints.

8. What is the literature on the consistency of paints and coatings, and the non-homogeneity of paints and spatial distributions of coatings?


Any of the texts previously cited for questions 2-4 would also contain sections on these topics.

9. What literature describes the frequency statistics of the use of various paints and coatings?

The list is extensive; examples of some of the more relevant articles follow.


10. What literature describes the quality review measures used in paints and coatings analysis?


11. What literature describes the uncertainty or confidence of paints and coatings analysis measurements?


12. What is the literature on the potential and actual cognitive bias in paints and coatings examinations?


13. What is the literature on contamination in forensic paints and coatings examinations?


14. What literature describes guidelines for reporting and interpretation of paints and coatings related findings?


15. What literature describes empiric evaluations of error rates in paints and coatings examinations?


16. What literature exists describing the instrumental analysis of paints and coatings and the significance of the information obtained there from?

The list is extensive; examples of some of the more relevant articles follow.


17. What literature exists describing the visual analysis of paints and coatings and the significance of the information obtained there from?


18. What databases are most needed in the field of paints and coatings analysis? (Note- this does not require a list of references, it is for informational purposes only.)
The existing PDQ Automotive Paint database is in need of increased consistent funding and support. The database is quite extensive and one of the most valuable tools to forensic paint examiners. Currently, it is a sixteen-year collaborative effort between local, state, and federal US law enforcement agencies and the Royal Canadian Mounted Police (developer of the platform) and has grown into an international database incorporating data from Europe, Asia, and Australia, all of whom participate in the program. The database requires a steady supply of samples in the ever-changing automotive paint market, and skilled analysts are required to ensure the quality of the data. Without additional funding and support, the forensic paint community could lose an extremely valuable resource.

A comprehensive current digital collection of infrared spectra of automotive refinish products on the market.

A comprehensive digital library of paint coloring and extender pigment Raman spectra.

A comprehensive digital library of paint coloring and extender pigment FTIR spectra.

19. What new technologies and areas of research should be pursued with regard to paints and coatings examination and analysis—and in what priority? (Note- this does not require a list of references, it is for informational purposes only.)

Aftermarket automotive refinish database: Create an aftermarket automotive paint refinish IR database to characterize current formulations and determine the ability to discriminate an aftermarket refinish from original equipment manufacturer (OEM) paint.

Architectural paint: Studies are needed to evaluate the homogeneity of architectural paints as applied in real-world settings under real-world conditions. Architectural paints could vary due to potential variations in the mixing and application technique(s) of the paint to a substrate. This study would begin to address what constitutes a significant difference between samples.

Error rates: Studies are needed to define and measure error rates with respect to false exclusions and an individual analyst’s competency in interpretation.

Error rates: Studies are needed to determine the discrimination potential of specific instruments or techniques comparing statistical models (e.g., PCA) to analysts’ interpretations.
Error rates: Studies are needed to look at the rate of false inclusions and exclusions based on analytical regimes utilized (e.g. FTIR only, microscopy only, combinations of techniques).

Emerging techniques: Determine the cost-benefit analysis and discrimination potential (to include factors such as sample size, sample condition) of emerging techniques for paint analysis (e.g., DART, DSC, Cathodoluminescence, LIBS) that will enhance the analytical scheme and/or replace existing traditional techniques (e.g., PGC/Py-GC/MS, SEM-EDS).

Determine the frequency of factory (OEM) refinishes as to how often and how many layers.